

# **IMPERIAL COUNTY AIR POLLUTION CONTROL DISTRICT**



**July 30, 2016  
Exceptional Event Documentation  
For the Imperial County PM<sub>10</sub> Nonattainment Area**

**FINAL DRAFT**  
**December 11, 2018**

## TABLE OF CONTENTS

SECTION	PAGE
I	Introduction .....1
I.1	Demonstration Contents .....2
I.2	Requirements of the Exceptional Event Rule .....3
I.2.a	Public Notification that a potential event was occurring (40 FR §50.14 (c)(1)) .....3
I.2.b	Initial Notification of Potential Exceptional Event (INPEE) (40 CFR §50.14 (c)(2)) .....3
I.2.c	Documentation that the public comment process was followed for the event demonstration that was flagged for exclusion (40 CFR §50.14 (c)(3)(v)) .....4
I.2.d	Documentation submittal supporting an Exceptional Event Flag (40 CFR §50.14 (c)(3)(i)) .....4
I.2.e	Necessary demonstration to justify an exclusion of data under (40 CFR §50.14 (c)(3)(iv)) .....4
II	July 30, 2016 Conceptual Model .....6
II.1	Geographic Setting and Monitor Locations .....6
II.2	Climate .....18
II.3	Event Day Summary .....24
III	Historical Concentrations .....37
III.1	Analysis .....37
III.2	Summary .....50
IV	Not Reasonably Controllable or Preventable .....52
IV.1	Background .....52
IV.1.a	Control Measures .....53
IV.1.b	Additional Measures .....54
IV.1.c	Review of Source Permitted Inspections and Public Complaints .....55
IV.2	Forecasts and Warnings .....57
IV.3	Wind Observations .....58
IV.4	Summary .....58
V	Clear Causal Relationship .....60
V.1	Discussion .....60
V.2	Summary .....84
VI	Conclusions .....85
VI.1	Affects Air Quality .....85

VI.2	Not Reasonably Controllable or Preventable .....	85
VI.3	Natural Event .....	86
VI.4	Clear Causal Relationship.....	86
VI.5	Historical Concentrations.....	86
Appendix A:	Public Notification that a potential event was occurring (40 CFR §50.14(c)(1)) .....	88
Appendix B:	Meteorological Data .....	109
Appendix C:	Correlated PM <sub>10</sub> Concentrations and Winds .....	126
Appendix D:	Regulation VIII – Fugitive Dust Rules .....	133

## LIST OF FIGURES

FIGURE	PAGE
Figure 2-1: Colorado Desert Area Imperial County .....	6
Figure 2-2: Surrounding Areas of the Salton Sea .....	7
Figure 2-3: Jacumba Peak.....	8
Figure 2-4: Anza-Borrego Desert State Park Carrizo Badlands .....	9
Figure 2-5: Anza-Borrego Desert State Park Desert View From Font's Point .....	10
Figure 2-6: Location and Topography of Imperial County .....	11
Figure 2-7: Deserts in California, Yuma and Mexico .....	12
Figure 2-8: Monitoring Sites in and Around Imperial County .....	13
Figure 2-9: Salton City Air Monitoring Station .....	14
Figure 2-10: Salton City Air Monitoring Station West.....	15
Figure 2-11: Naval Test Base Air Monitoring Station .....	15
Figure 2-12: Naval Test Base Air Monitoring Station West.....	16
Figure 2-13: Sonny Bono Air Monitoring Station .....	16
Figure 2-14: Sonny Bono Salton Sea National Wildlife Refuge .....	17
Figure 2-15: Sonoran Desert Region .....	19
Figure 2-16: Imperial County Historical Weather .....	20
Figure 2-17: Weather Pattern of the North American Monsoon .....	22
Figure 2-18: Conceptual Diagram of Gulf surge Trigger .....	23
Figure 2-19: Monsoonal Air Mass Surges North July 29, 2016 .....	25
Figure 2-20: Monsoonal System Dominates the Southwest.....	26

Figure 2-21:	Monsoonal Air Draws Closer July 29, 2016 and July 30, 2016.....	27
Figure 2-22:	Progression of Monsoonal System .....	28
Figure 2-23:	Monsoonal Air Mass Surges North July 30, 2016 .....	29
Figure 2-24:	Ramp up Analysis July 30, 2016 .....	31
Figure 2-25:	HYSPLIT Model Ending 0000 July 30, 2016.....	33
Figure 2-26:	HYSPLIT Model Ending 1200 July 30, 2016.....	34
Figure 2-27:	72-hour Wind Speeds at Regional Airports.....	35
Figure 2-28:	72-hour PM <sub>10</sub> Concentrations at Various Sites.....	36
Figure 3-1	Brawley Historical FRM and FEM PM <sub>10</sub> 24-Hr Avg Concentrations January 1, 2010 to July 30, 2016.....	38
Figure 3-2	Calexico Historical FRM and FEM PM <sub>10</sub> 24-Hr Avg Concentrations January 1, 2010 to July 30, 2016.....	39
Figure 3-3	El Centro Historical FRM and FEM PM <sub>10</sub> 24-Hr Avg Concentrations January 1, 2010 to July 30, 2016.....	40
Figure 3-4	Niland Historical FRM and FEM PM <sub>10</sub> 24-Hr Avg Concentrations January 1, 2010 to July 30, 2016.....	41
Figure 3-5	Westmorland Historical FRM PM <sub>10</sub> 24-Hr Avg Concentrations January 1, 2010 to July 30, 2016.....	42
Figure 3-6	Brawley Seasonal Comparison PM <sub>10</sub> 24-Hr Avg Concentrations July 1, 2010 Through September 30, 2016 .....	43
Figure 3-7	Calexico Seasonal Comparison PM <sub>10</sub> 24-Hr Avg Concentrations July 1, 2010 Through September 30, 2016 .....	44
Figure 3-8	El Centro Seasonal Comparison PM <sub>10</sub> 24-Hr Avg Concentrations July 1, 2010 Through September 30, 2016 .....	45
Figure 3-9	Niland Seasonal Comparison PM <sub>10</sub> 24-Hr Avg Concentrations July 1, 2010 Through September 30, 2016 .....	46

Figure 3-10	Westmorland Seasonal Comparison PM <sub>10</sub> 24-Hr Avg Concentrations July 1, 2010 Through September 30, 2016 .....	47
Figure 3-11	Brawley Historical PM <sub>10</sub> 24 Hr FRM & FEM Concentrations January 1, 2010 through July 30, 2016 .....	48
Figure 3-12	Calexico Historical PM <sub>10</sub> 24 Hr FRM & FEM Concentrations January 1, 2010 through July 30, 2016 .....	48
Figure 3-13	El Centro Historical PM <sub>10</sub> 24 Hr FRM & FEM Concentrations January 1, 2010 through July 30, 2016 .....	49
Figure 3-14	Niland Historical PM <sub>10</sub> 24 Hr FRM & FEM Concentrations January 1, 2010 through July 30, 2016 .....	49
Figure 3-15	Westmorland PM <sub>10</sub> 24 Hr FRM & FEM Concentrations January 1, 2010 through July 30, 2016 .....	50
Figure 4-1	Regulation VIII Graphic Timeline Development.....	53
Figure 4-2	Permitted Sources.....	56
Figure 4-3	Non-Permitted Sources.....	57
Figure 5-1	GOES Visible Satellite July 30, 2016.....	61
Figure 5-2	Dense and Widespread Dust Warnings Issued for the Region .....	62
Figure 5-3	Terra MODIS Captures Aerosols over Imperial County — July 30, 2016.....	63
Figure 5-4	Terra MODIS Captures Dust-Sized Aerosols over Imperial County — July 30, 2016 .....	64
Figure 5-5	Intense Storm Cells Captured by NEXRAD Radar.....	65
Figure 5-6	Raised Dust Upstream of Imperial County.....	66
Figure 5-7	Exceedance Analysis for Saturday July 30, 2016.....	73
Figure 5-8	Brawley PM <sub>10</sub> Concentrations and Wind Speed Correlation.....	74
Figure 5-9	Calexico PM <sub>10</sub> Concentrations and Wind Speed Correlation.....	75
Figure 5-10	El Centro PM <sub>10</sub> Concentrations and Wind Speed Correlation.....	76

Figure 5-11	Niland PM <sub>10</sub> Concentrations and Wind Speed Correlation.....	77
Figure 5-12	Westmorland PM <sub>10</sub> Concentrations and Wind Speed Correlation.....	78
Figure 5-13	PM <sub>10</sub> Concentrations & Upstream Wind Speed Correlations.....	79
Figure 5-14	72-hour Time Series PM <sub>10</sub> Concentrations and Visibility.....	80
Figure 5-15	Imperial Valley Air Quality Index in Brawley July 30, 2016.....	81
Figure 5-16	Imperial Valley Air Quality Index in Calexico July 30, 2016.....	82
Figure 5-17	Imperial Valley Air Quality Index in El Centro July 30, 2016.....	82
Figure 5-18	Imperial Valley Air Quality Index in Niland July 30, 2016.....	83
Figure 5-19	Imperial Valley Air Quality Index in Westmorland July 30, 2016.....	83
Figure 5-20	July 30, 2016 Wind Event Takeaway Points.....	84

## LIST OF TABLES

TABLE	PAGE
Table 1-1	Concentrations of PM <sub>10</sub> on July 30, 2016 .....1
Table 2-1	Monitoring Sites in Imperial County, Riverside County and Arizona July 30, 2016 .....18
Table 2-2	Wind Speeds on July 30, 2016 .....32
Figure 5-1	Brawley PM <sub>10</sub> Concentrations and Wind Speeds on July 30, 2016.....67
Figure 5-2	Calexico PM <sub>10</sub> Concentrations and Wind Speeds on July 30, 2016.....68
Figure 5-3	El Centro PM <sub>10</sub> Concentrations and Wind Speeds on July 30, 2016.....69
Figure 5-4	Niland PM <sub>10</sub> Concentrations and Wind Speeds on July 30, 2016.....70
Figure 5-5	Westmorland PM <sub>10</sub> Concentrations and Wind Speeds on July 30, 2016.....71
Table 6-1	Technical Elements Checklist Exceptional Event Demonstration for High Wind Dust Event (PM <sub>10</sub> ) .....85

**ACRONYM DESCRIPTIONS**

AOD	Aerosol Optical Depth
AQI	Air Quality Index
AQS	Air Quality System
BACM	Best Available Control Measures
BAM 1020	Beta Attenuation Monitor Model 1020
BLM	United States Bureau of Land Management
BP	United States Border Patrol
CAA	Clean Air Act
CARB	California Air Resources Board
CMP	Conservation Management Practice
DCP	Dust Control Plan
DPR	California Department of Parks and Recreation
EER	Exceptional Events Rule
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GOES-W/E	Geostationary Operational Environmental Satellite (West/East)
HC	Historical Concentrations
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory Model
ICAPCD	Imperial County Air Pollution Control District
INPEE	Initial Notification of a Potential Exceptional Event
ITCZ	Inter Tropical Convergence Zone
KBLH	Blythe Airport
KCZZ	Campo Airport
KIPL	Imperial County Airport
KNJK	El Centro Naval Air Station
KNYL/MCAS	Yuma Marine Corps Air Station
KPSP	Palm Springs International Airport
KTRM	Jacqueline Cochran Regional Airport (aka Desert Resorts Rgnl Airport)
PST	Local Standard Time
MMML/MXL	Mexicali, Mexico Airport
MODIS	Moderate Resolution Imaging Spectroradiometer
MPH	Miles Per Hour
MST	Mountain Standard Time
NAAQS	National Ambient Air Quality Standard
NCAR	National Center for Atmospheric Research
NCEI	National Centers for Environmental Information
NEAP	Natural Events Action Plan
NEXRAD	Next-Generation Radar
NOAA	National Oceanic and Atmospheric Administration

nRCP	Not Reasonably Controllable or Preventable
NWS	National Weather Service
PDT	Pacific Daylight Time
PM <sub>10</sub>	Particulate Matter less than 10 microns
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns
PST	Pacific Standard Time
QA/QC	Quality Assured and Quality Controlled
QCLCD	Quality Controlled Local Climatology Data
RACM	Reasonable Available Control Measure
RAWS	Remote Automated Weather Station
SIP	State Implementation Plan
SLAMS	State Local Ambient Air Monitoring Station
SMP	Smoke Management Plan
SSI	Size-Selective Inlet
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTC	Coordinated Universal Time
WRCC	Western Regional Climate Center

## I Introduction

On July 30, 2016, State and Local Ambient Air Monitoring Stations (SLAMS), located in Brawley (AQS Site Code 060250007), Calexico (AQS Site Code 060251003), El Centro (AQS Site Code 060251003), Niland (060254004) and Westmorland (AQS Site Code 060254003), California measured an exceedance of the National Ambient Air Quality Standard (NAAQS). The Federal Equivalent Method (FEM), Beta Attenuation Monitor Model 1020 (BAM 1020) measured (midnight to midnight) 24-hr average Particulate Matter less than 10 microns (PM<sub>10</sub>) concentrations of 195 µg/m<sup>3</sup>, 158 µg/m<sup>3</sup>, 205 µg/m<sup>3</sup>, 206 µg/m<sup>3</sup>, and 201 µg/m<sup>3</sup> (**Table 1-1**). PM<sub>10</sub> 24-hr measurements above 150 µg/m<sup>3</sup> are exceedances of the NAAQS. All five SLAMS located in Imperial County measured an exceedance of the PM<sub>10</sub> NAAQS on July 30, 2016.

**TABLE 1-1**  
**CONCENTRATIONS OF PM<sub>10</sub> ON JULY 30, 2016**

DATE	MONITORING SITE	AQS ID	POC(s)	HOURS	24-HOUR CONCENTRATION µg/m <sup>3</sup>	PM <sub>10</sub> NAAQS µg/m <sup>3</sup>
7/30/2016	Brawley	06-025-0007	3	22	195	150
7/30/2016	Calexico	06-025-0005	3	24	158	150
7/30/2016	El Centro	06-025-1003	4	24	205	150
7/30/2016	Niland	06-025-4004	3	22	206	150
7/30/2016	Westmorland	06-025-4003	3	22	201	150

All time referenced throughout this document is in Pacific Standard Time (PST) unless otherwise noted<sup>1</sup>

July 30, 2016 not a scheduled sampling day

The Imperial County Air Pollution Control District (ICAPCD) has been submitting PM<sub>10</sub> data from Federal Reference Method (FRM) Size Selective Inlet (SSI) instruments since 1986 into the United States Environmental Protection Agency's (USEPA) Air Quality System (AQS). Prior to 2013 all continuous measured PM<sub>10</sub> data was non-regulatory, thus measured in local conditions. However, by 2013 ICAPCD began formally submitting continuous FEM PM<sub>10</sub> data from BAM 1020's into the USEPA managed AQS. Because regulatory consideration of reported data must be in standard conditions, as required by USEPA, all continuous PM<sub>10</sub> data since 2013 is regulatory. On July 30, 2016, all five air monitors within Imperial County were impacted by elevated particulate matter caused by the transport of fugitive windblown dust from outflow winds associated with monsoonal thunderstorms that developed along the Lower Colorado River Valley during the evening hours of July 29, 2016 through July 30, 2016.

This report demonstrates that a naturally occurring event caused an exceedance observed on July 30, 2016, which elevated particulate matter and affected air quality. The report provides concentration to concentration monitoring site analyses supporting a clear causal relationship

<sup>1</sup> According to the National Institute of Standards and Technology (NIST) Time and Frequency Division the designation of the time of day for specific time zones are qualified by using the term "standard time" or "daylight time". For year-round use the designation can be left off inferring "local time" daylight or standard whichever is present. For 2016, Pacific Daylight Time (PDT) is March 13 through November 6. <https://www.nist.gov/pml/time-and-frequency-division/local-time-faqs#intl>

between the event and the monitored exceedance and provides an analysis supporting the not reasonably controllable or preventable (nRCP) criteria. Furthermore, the report provides information that the exceedances would not have occurred without the transport of windblown dust from outlying deserts and mountains within the Sonoran Desert. The document further substantiates the request by the ICAPCD to exclude PM<sub>10</sub> 24-hour NAAQS exceedances of 195 µg/m<sup>3</sup>, 158 µg/m<sup>3</sup>, 205 µg/m<sup>3</sup>, 206 µg/m<sup>3</sup>, and 201 µg/m<sup>3</sup> (**Table 1-1**) as an exceptional event. This demonstration substantiates that this event meets the definition of the USEPA Regulation for the Treatment of Data Influenced by Exceptional Events (EER).<sup>2</sup>

## I.1 Demonstration Contents

Section II - Describes the July 30, 2016 event as it occurred in Arizona, California and Imperial County, providing background information of the exceptional event and explaining how the wind driven emissions from the event led to the exceedance at the all five air monitors in Imperial County.

Section III – Using time-series graphs, summaries and historical concentration comparisons of the Brawley, Calexico, El Centro, Niland, and Westmorland stations this section discusses and establishes how the July 30, 2016 event affected air quality such that a clear causal relationship is demonstrated between the event and the monitored exceedance. It is perhaps of some value to mention that the time-series graphs include PM<sub>10</sub> data measured in both local conditions and standard conditions. Measured PM<sub>10</sub> continuous data prior to 2013 is in local conditions, all other data is in standard conditions. The concentration difference between local and standard conditions has an insignificant impact on any data analysis. Overall, this section provides the evidence that human activity played little or no direct causal role in the July 30, 2016 event and its resulting emissions defining the event as a “natural event”.<sup>3</sup>

Section IV - Provides evidence that the event of July 30, 2016 was not reasonably controllable or preventable despite the full enforcement and implementation of Best Available Control Measures (BACM).

Section V - Brings together the evidence presented within this report to show that the exceptional event affected air quality; that the event was not reasonably controllable or preventable; that there was a clear causal relationship between the event and the exceedance, and that the event was a natural event.

---

<sup>2</sup> "Treatment of Data Influenced by Exceptional Events; Final Guidance", 81 FR 68216, October 2, 2016

<sup>3</sup> Title 40 Code of Federal Regulations part 50: §50.1(k) Natural event means an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.

## **I.2 Requirement of the Exceptional Event Rule**

The above sections combined comprise the technical requirements described under the Exceptional Events Rule (EER) under 40 CFR §50.14(c)(3)(iv). However, in order for the USEPA to concur with flagged air quality monitoring data, there are additional non-technical requirements.

### **I.2.a Public Notification that a potential event was occurring (40 CFR §50.14(c)(1))**

The ICAPCD published the National Weather Service (NWS) forecast for July 28, 2016 through August 1, 2016. The published notification, via the ICAPCD's webpage, forecast included the increase of monsoonal moisture for the weekend with an increased chance of showers and thunderstorms within the San Diego Mountains and deserts each afternoon and evening. The high-pressure was expected to weaken starting Friday, July 29, 2016 with better moisture profiles streaming north throughout the region with thunderstorm activity affecting the region in Arizona and California through the weekend. In addition to the ICAPCD posting, the Phoenix and San Diego NWS offices published weather stories advising of the potential for increased thunderstorm activity. The Phoenix NWS office published weather briefings for July 29, 2016, July 30, 2016 and July 31, 2016. Each briefing advised of the potential strong damaging winds, dense blowing dust, large hail and torrential rainfall in areas such as southwest and south-central Arizona, including Yuma, La Paz Maricopa, Pinal, and Gila counties with a somewhat lesser chance in southeast California. Nonetheless, the NWS advisories were well in advance of any actual monsoonal activity. Due to the potential for suspended particles and poor air quality, the ICAPCD issued a "No Burn" day advisory for Imperial County July 30, 2016. **Appendix A** contains copies of notices pertinent to the July 30, 2016 event.

### **I.2.b Initial Notification of Potential Exceptional Event (INPEE) (40 CFR §50.14(c)(2))**

States are required under federal regulation to submit measured ambient air quality data into the AQS. AQS is the federal repository of Quality Assured and Quality Controlled (QA/QC) ambient air data used for regulatory purposes. When States intend to request the exclusion of one or more exceedances of a NAAQS as an exceptional event a notification to the Administrator is required. The notification is accomplished by flagging the data in AQS and providing an initial event description.

On October 3, 2016, the US EPA promulgated revisions to the Exceptional Events rule, which included the requirement of an "Initial Notification of Potential Exceptional Event" (INPEE) process. This revised INPEE process requires communication between the US EPA regional office and the State, prior to the development of a demonstration. The intent of the INPEE process is twofold: to determine whether identified data may affect a regulatory decision and whether a State should develop/submit an EE Demonstration.

The ICAPCD made a formal written request to the California Air Resources Board (CARB) to place preliminary flags on SLAMS measured PM<sub>10</sub> concentrations from the Brawley, Calexico, El Centro, and Westmorland monitors on April 17, 2017. The INPEE, for the July 30, 2016 event, was

formally submitted by the CARB to USEPA Region 9 on April 24, 2017. Subsequently there after a second revised request was sent to CARB requesting preliminary flags on additional days during 2016. **Table 1-1** above provides the PM<sub>10</sub> measured concentrations for all monitors in Imperial County for July 30, 2016. A brief description of the meteorological conditions was provided to CARB, which provided preliminary information that indicated a potential natural event had occurred on July 30, 2016.

**I.2.c Documentation that the public comment process was followed for the event demonstration that was flagged for exclusion (40 CFR §50.14(c)(3)(v))**

The ICAPCD posted, for a 30-day public review, a draft version of this demonstration on the ICAPCD webpage and published a notice of availability in the Imperial Valley Press on June 28, 2018. The notice advised the public that comments were being solicited regarding this demonstration, which supports the request, by the ICAPCD, to exclude the measured concentrations of 195 µg/m<sup>3</sup>, 158 µg/m<sup>3</sup>, 205 µg/m<sup>3</sup>, 206 µg/m<sup>3</sup>, and 201 µg/m<sup>3</sup> which occurred on July 30, 2016 in Brawley, Calexico, El Centro, Niland, and Westmorland (**Table 1-1**). The final closing date for comments was July 30, 2018. **Appendix A** contains a copy of the public notice affidavit along with any comments received by the ICAPCD for submittal as part of the demonstration (40 CFR §50.14(c)(3)(v)).

**I.2.d Documentation submittal supporting an Exceptional Event Flag (40 CFR §50.14(c)(3)(i))**

States that have flagged data as a result of an exceptional event and who have requested an exclusion of said flagged data are required to submit a demonstration that justifies the data exclusion to the USEPA in accordance with the due date established by USEPA during the INPEE process (40 CFR §50.14(c)(2)). Currently, bi-weekly meetings between USEPA, CARB and Imperial County are set to discuss each flagged exceedance for 2016.

The ICAPCD, after the close of the comment period and after consideration of the comments will submit this demonstration along with all required elements, including received comments and responses to USEPA Region 9 in San Francisco, California. The submittal of the July 30, 2016 demonstration will have a regulatory impact upon the development and ultimate submittal of the PM<sub>10</sub> State Implementation Plan for Imperial County in 2018.

**I.2.e Necessary demonstration to justify an exclusion of data under (40 CFR§50.14(c)(3)(iv))**

- A This demonstration provides evidence that the event, as it occurred on July 30, 2016, satisfies the definition in 40 CFR §50.1(j) and (k) for an exceptional event.
  - a The event created the meteorological conditions that entrained emissions and caused the exceedance.
  - b The event clearly “affects air quality” such that there is the existence of a clear causal relationship between the event and the exceedance.

- c Analysis demonstrates that the event-influenced concentrations compared to concentrations at the same monitor at other times supports the clear causal relationship.
  - d The event “is not reasonably controllable and not reasonably preventable.”
  - e The event is “caused by human activity that is unlikely to recur at a particular location or [is] a natural event.”
  - f The event is a “natural event” where human activity played little or no direct causal role.
- B This demonstration provides evidence that the exceptional event affected air quality in Imperial County by demonstrating a clear causal relationship between the event and the measured concentrations in Brawley, Calexico, El Centro, and Westmorland.
- C This demonstration provides evidence of the measured concentrations to concentrations at the same monitor at other times supporting the clear causal relationship between the event and the affected monitor.

## II July 30, 2016 Conceptual Model

This section provides a summary description of the meteorological and air quality conditions under which the July 30, 2016 event unfolded in Imperial County. The subsection elements include

- » A description and map of the geographic setting of the air quality and meteorological monitors
- » A description of Imperial County's climate
- » An overall description of meteorological and air quality conditions on the event day.

### II.1 Geographic Setting and Monitor Locations

According to the United States Census Bureau, Imperial County has a total area of 4,482 square miles of which 4,177 square miles is land and 305 square miles is water. Much of Imperial County is below sea level and is part of the Colorado Desert an extension of the larger Sonoran Desert (Figure 2-1). The Colorado Desert not only includes Imperial County but a portion of San Diego County.

**FIGURE 2-1  
COLORADO DESERT AREA IMPERIAL COUNTY**



**Fig 2-1:** 1997 California Environmental Resources Evaluation System. According to the United States Geological Survey (USGS) Western Ecological Research Center the Colorado Desert bioregion is part of the bigger Sonoran Desert Bioregion which includes the Colorado Desert and Upper Sonoran Desert sections of California and Arizona, and a portion of the Chihuahuan Basin and Range Section in Arizona and New Mexico (Forest Service 1994)

A notable feature in Imperial County is the Salton Sea, which is at approximately 235 feet below sea level. The Chocolate Mountains are located east of the Salton Sea and extend in a northwest-southeast direction for approximately 60 miles (**Figure 2-2**). In this region, the geology is dominated by the transition of the tectonic plate boundary from rift to fault. The southernmost strands of the San Andreas Fault connect the northern-most extensions of the East Pacific rise. Consequently, the region is subject to earthquakes and the crust is being stretched, resulting in a sinking of the terrain over time.

**FIGURE 2-2**  
**SURROUNDING AREAS OF THE SALTON SEA**



**Fig 2-2:** Image courtesy of the Image Science and Analysis Laboratory NASA Johnson Space Center, Houston Texas

All of the seven incorporated cities, including the unincorporated township of Niland, are surrounded by agricultural fields to the north, east, west and south (**Figure 2-6**). Together, the incorporated cities, including Niland, and the agricultural fields make what is known as the Imperial Valley. Surrounding the Imperial Valley are desert areas found on the eastern and western portions of Imperial County.

The desert area, found within the western portion of Imperial County is of note because of its border with San Diego County. From west to east, San Diego County stretches from the Pacific Ocean to its boundary with Imperial County. San Diego County has a varied topography. On its western side is 70 miles (110 km) of coastline. Most of San Diego between the coast and the Laguna Mountains consists of hills, mesas, and small canyons. Snow-capped (in winter)

mountains rise to the northeast, with the Sonoran Desert to the far east. Cleveland National Forest is spread across the central portion of the county, while the Anza-Borrego Desert State Park occupies most of the northeast. The southeastern portion of San Diego County is comprised of distinctive Peninsular mountain ranges. The mountains and deserts of San Diego comprise the eastern two-thirds of San Diego County and are primarily undeveloped back country with a native plant community known as chaparral. Of the nine major mountain ranges within San Diego County, the In-Ko-Pah Mountains and the Jacumba Mountains border Mexico and Imperial County.

Both mountain ranges provide the distinctive weathered dramatic piles of residual boulders that can be seen while driving Interstate 8 from Imperial County through Devil's Canyon and In-Ko-Pah Gorge. Interstate 8 runs along the US border with Mexico from San Diego's Mission Bay to just southeast of Casa Grande Arizona.

**FIGURE 2-3**  
**JACUMBA PEAK**



**Fig 2-3:** The Jacumba Mountains reach an elevation of 4,512 feet (1,375 m) at Jacumba Peak, near the southern end of the chain. Source: Wikipedia at [https://en.wikipedia.org/wiki/Jacumba\\_Mountains](https://en.wikipedia.org/wiki/Jacumba_Mountains)

Northwest and northeast of the Jacumba Mountains is the Tierra Blanca Mountains, the Sawtooth Mountains and Anza-Borrego Desert State Park. Within the mountain ranges and the Anza-Borrego Desert State Park, there exists the Vallecito Mountains, the Carrizo Badlands, the Carrizo Impact Area, Coyote Mountains and the Volcanic Hills to name of few. Characteristically, these areas all have erosion that has occurred over time that extends from the Santa Rosa Mountains into northern Baja California in Mexico. For example, the Coyote Mountains consists of sand dunes left over from the ancient inland Sea of Cortez. Much of the terrain is still loose dirt, interspersed with sandstone and occasional quartz veins. The nearest community to the Coyote Mountain range is the community of Ocotillo. Of interest are the fossilized and hollowed out sand dunes that produce wind caves.

**FIGURE 2-4**  
**ANZA-BORREGO DESERT STATE PARK**  
**CARRIZO BADLANDS**



**Fig 2-4:** View southwest across the Carrizo Badlands from the Wind Caves in Anza-Borrego Desert State Park. Source: Wikipedia at [https://en.wikipedia.org/wiki/Carrizo\\_Badlands](https://en.wikipedia.org/wiki/Carrizo_Badlands)

The Carrizo Badlands, which includes the Carrizo Impact Area used by the US Navy as an air-to-ground bombing range during World War II and the Korean War, lies within the Anza-Borrego Desert State Park. The Anza-Borrego Desert State Park is located within the Colorado Desert, is the largest state park in California occupying eastern San Diego County, reaching into Imperial and Riverside counties. The two communities within Anza-Borrego Desert State Park are Borrego Springs and Shelter Valley.

The Anza-Borrego Desert State Park lies in a unique geologic setting along the western margin of the Salton Trough. The area extends north from the Gulf of California to San Geronio Pass and from the eastern rim of the Peninsular Ranges eastward to the San Andreas Fault zone along the far side of the Coachella Valley. The Anza-Borrego region changed gradually over time from intermittently being fed by the Colorado River Delta to dry lakes and erosion from the surrounding mountain ranges. The area located within the southeastern and northeastern section of San Diego County is a source of entrained fugitive dust emissions that impact Imperial County when westerly winds funnel through the unique landforms causing in some cases wind tunnels that cause increases in wind speeds.

Historical observations have indicated that the desert slopes and mountains of San Diego are a source of fugitive emissions along with those deserts located to the east and west of Imperial County, which extend into Mexico (Sonoran Desert, **Figure 2-7**). Combined, the desert areas and mountains of San Diego and the desert areas that extend into Mexico are sources of dust emissions, which affect the Imperial County during high wind events.

**FIGURE 2-5**  
**ANZA-BORREGO DESERT STATE PARK**  
**DESERT VIEW FROM FONT'S POINT**

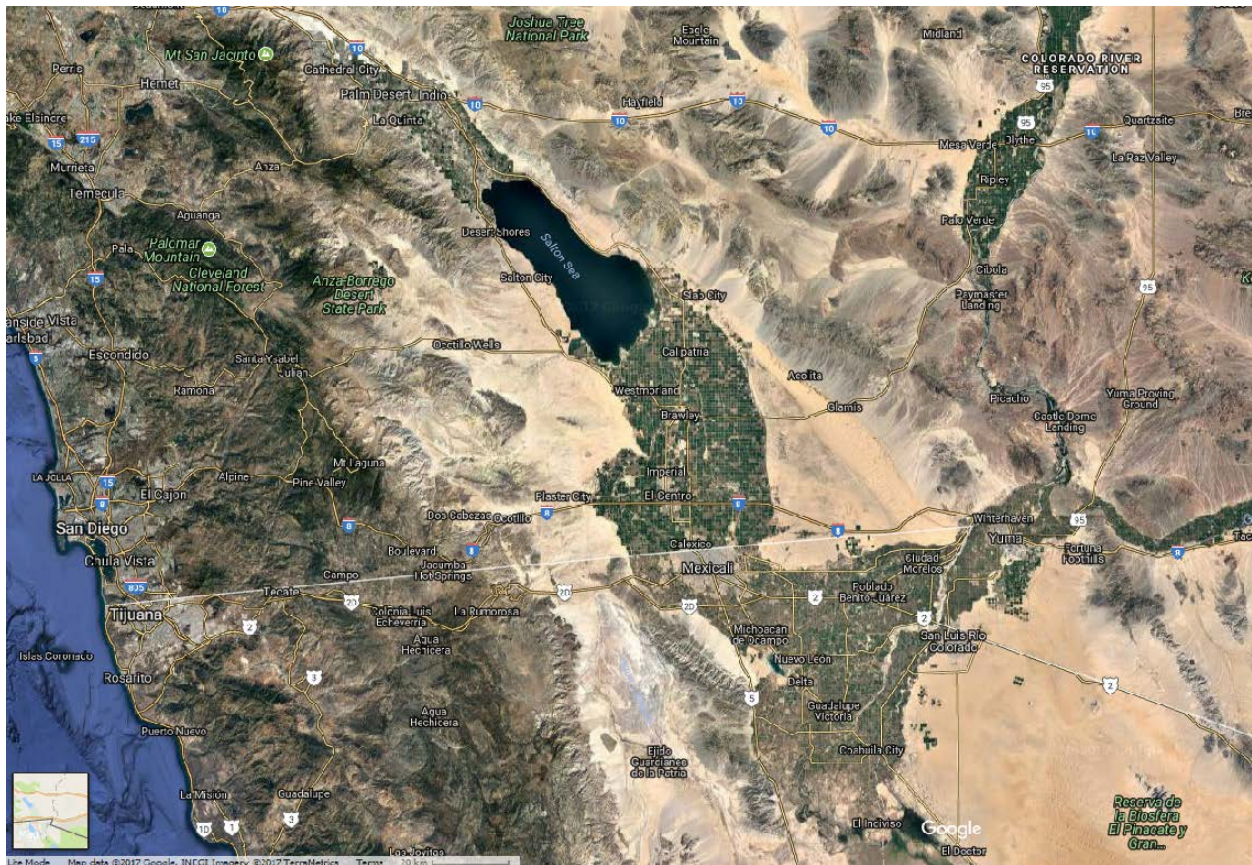


**Fig 2-5:** Desert view from Font's Point. Source: Font's Point Anza-Borrego Photographed by and copyright of (c) David Corby; Wikipedia at [https://en.wikipedia.org/wiki/Anza-Borrego\\_Desert\\_State\\_Park](https://en.wikipedia.org/wiki/Anza-Borrego_Desert_State_Park)

Map of Imperial County, California, showing the locations of various communities. The county is outlined in red. Communities marked with orange dots and labels include Niland, Calipatria, Westmorland, Brawley, Imperial, Holtville, El Centro, Calexico, and Mexicali, Mexico. The Colorado River is shown as a large black area on the left.

11

**FIGURE 2-7**  
**DESERTS IN CALIFORNIA, YUMA AND MEXICO**



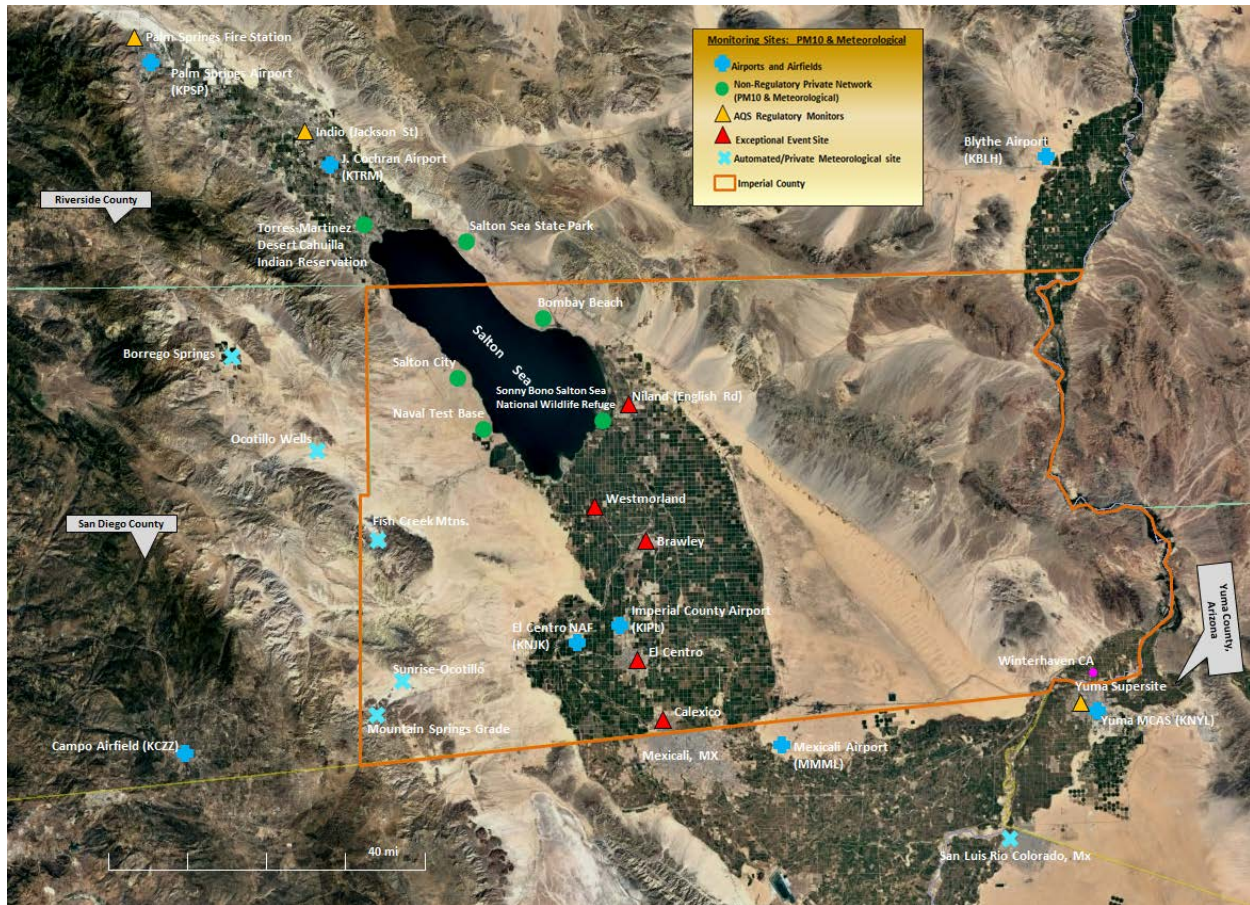
**Fig 2-7:** Depicts the Sonoran Desert as it extends from Mexico into Imperial County.

Source: Google Earth Terra Metrics

The air quality and meteorological monitoring stations used in this demonstration are shown in **Figure 2-8**. Of the five SLAMS within Imperial County four stations measure both meteorological and air quality data. These SLAMS are located in Calexico, El Centro, Westmorland, and Niland; the station located in Brawley only measures air quality. Other air monitoring stations measuring air quality and meteorological data used for this demonstration include stations in eastern Riverside County, southeastern San Diego County and southwestern Arizona (Yuma County) (**Figure 2-8 and Table 2-1**).

As mentioned above, the  $PM_{10}$  exceedances on July 30, 2016, occurred at the Brawley, Calexico, El Centro, Niland and Westmorland stations. The Brawley, Niland, and Westmorland stations are regarded as the “northern” monitoring sites within the Imperial County air monitoring network. In order to properly analyze the contributions from meteorological conditions occurring on July 30, 2016, other meteorological sites were used in this demonstration such as airports in eastern Riverside County, southeastern San Diego County, southwestern Arizona (Yuma County), Imperial County, and other sites relevant to the event, such as within northern Mexico. (**Figure 2-8 and Appendix B**).

**FIGURE 2-8**  
**MONITORING SITES IN AND AROUND IMPERIAL COUNTY**

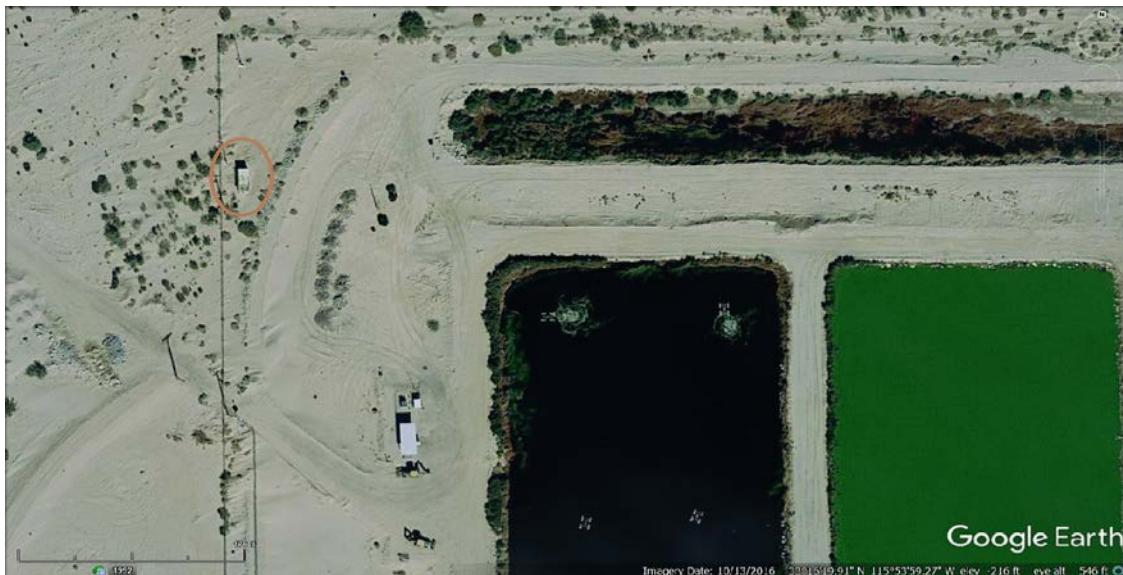


**Fig 2-8:** Depicts a select group of meteorological and PM<sub>10</sub> monitoring sites in Imperial County, eastern Riverside County, southeastern San Diego County, southwestern Arizona (Yuma County), and northern Mexico. The image provides the location of potential sites used to gather data in support an Exceptional Event Demonstration. Source: Google Earth

In addition to meteorological sites, there are non-regulatory PM<sub>10</sub> sites located around the Salton Sea that maybe referenced as an aid to help the reader understand the direction and velocity of winds that affect Imperial County. Unless, otherwise specifically indicated concentration references do not imply emissions from the surrounding playa of the Salton Sea. Three sites, in specific, are the Salton City air monitoring station, the Naval Test Base air monitoring station and the Sonny Bono air monitoring station. These privately owned and non-regulatory stations are located closest to the Imperial County air monitoring network (**Figures 2-9 to 2-12**). The Salton City station is located 33.27275°N latitude and 115.90062°W longitude, on the western edge of the Salton Sea (**Figure 2-9**). The station abuts a water reservoir along the Salton Sea with surrounding chaparral vegetation and unpaved open areas and roads. The Naval Test Base station is located 33.16923°N latitude and 115.85593°W longitude, on the southwestern edge of the Salton Sea (**Figure 2-11**). The station sits on an abandoned US Military site, still owned by the Department of Defense. Unlike the Salton City station, light chaparral vegetation and sandy open

dune areas surround the Naval Test Base station. Directly to the west of the station is an orchard. The Sonny Bono station is located 33.17638°N latitude and 115.62310°W longitude, on the southern portion of the Salton Sea within the Sonny Bono Salton Sea Wildlife Refuge. The Sonny Bono Salton Sea National Wildlife Refuge is 40 miles north of the Mexican border at the southern end of the Salton Sea within the Sonoran Desert. The Refuge has two separate managed units, 18 miles apart. Each unit contains wetland habitats, farm fields, and tree rows. The land of the Salton Sea Refuge is flat, except for Rock Hill, a small, inactive volcano, located near Refuge Headquarters. Bordering the Refuge is the Salton Sea on the north and farmlands on the east, south, and west.

**FIGURE 2-9**  
**SALTON CITY AIR MONITORING STATION**



**Fig 2-9:** Depicts the Salton City air monitoring (circled) site operated by a private entity. View site photos at the California Air Resources Board monitoring website at [https://www.arb.ca.gov/qaweb/sitephotos.php?site\\_no=13604&date=17](https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17)

**FIGURE 2-10**  
**SALTON CITY AIR MONITORING STATION**  
**WEST**



**Fig 2-10:** Photograph taken by the California Air Resources Board audit team in 2017. The photograph taken from the west facing the probe.  
[https://www.arb.ca.gov/qaweb/sitephotos.php?site\\_no=13604&date=17](https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17)

**FIGURE 2-11**  
**NAVAL TEST BASE AIR MONITORING STATION**



**Fig 2-11:** Depicts the Naval Test Base air monitoring (circled) site operated by a private entity. To view the site photos visit the California Air Resources Board monitoring website at [https://www.arb.ca.gov/qaweb/sitephotos.php?site\\_no=13603&date=17](https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13603&date=17)

**FIGURE 2-12**  
**NAVAL TEST BASE AIR MONITORING STATION**  
**WEST**



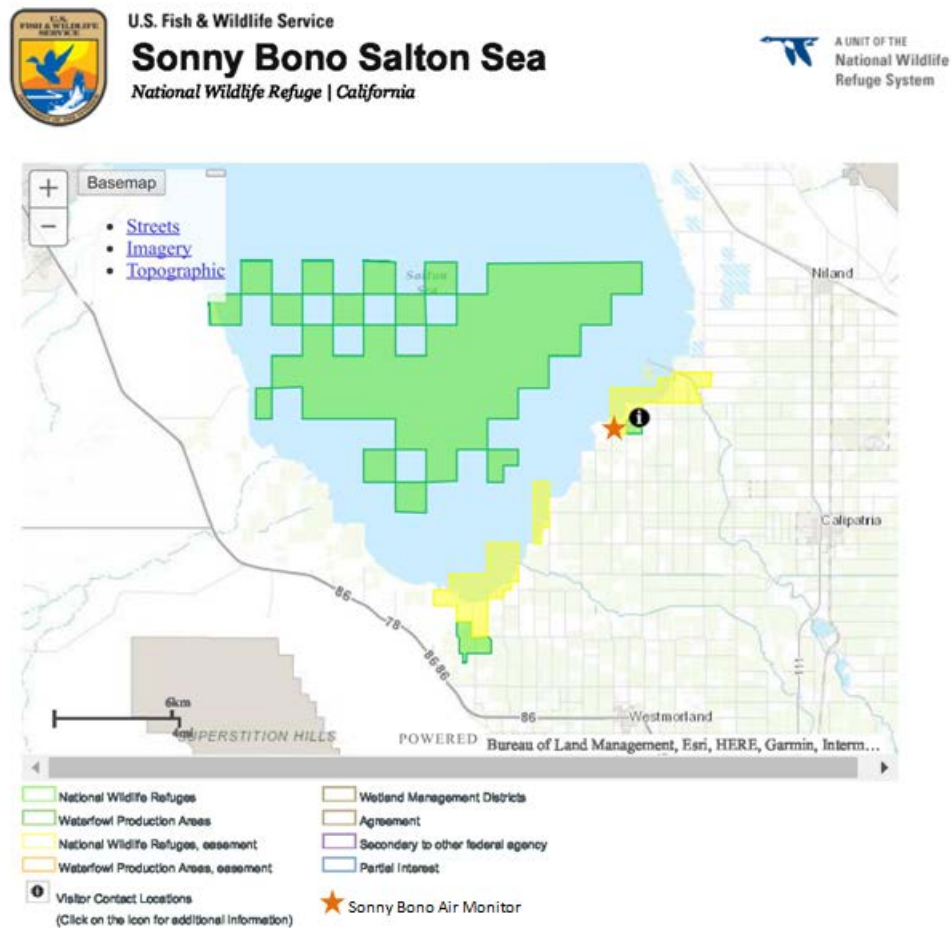
**Fig 2-12:** Photograph taken by the California Air Resources Board audit team in 2017. The photograph taken from the west facing the probe.  
[https://www.arb.ca.gov/qaweb/sitephotos.php?site\\_no=13604&date=17](https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17)

**FIGURE 2-13**  
**SONNY BONO AIR MONITORING STATION**



**Fig 2-13:** Depicts the Sonny Bono air monitoring (circled) site operated by a private entity. To view the site photos visit the California Air Resources Board monitoring website at  
[https://www.arb.ca.gov/qaweb/sitephotos.php?site\\_no=13604&date=17](https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17)

**FIGURE 2-14**  
**SONNY BONO SALTON SEA NATIONAL WILDLIFE REFUGE**



**Fig 2-14:** The Sonny Bono Wildlife Refuge has about 2,000 acres that are farmed and managed for wetlands. In 1998, the Refuge was renamed after Congressman Sonny Bono, who helped inform the U.S. Congress of the environmental issues facing the Salton Sea as well as acquiring funding for this Refuge to help it respond to avian disease outbreaks and other habitat challenges at the Salton Sea. Source: [https://www.fws.gov/refuge/Sonny\\_Bono\\_Salton\\_Sea/about.html](https://www.fws.gov/refuge/Sonny_Bono_Salton_Sea/about.html)

**TABLE 2-1**  
**MONITORING SITES IN IMPERIAL COUNTY, RIVERSIDE COUNTY AND ARIZONA**  
**JULY 30, 2016**

Monitor Site Name	*Operator	Monitor Type	AQS ID	AQS PARAMETER CODE	ARB Site Number	Elevation (meters)	24-hr PM <sub>10</sub> (µg/m³) Avg	1-hr PM <sub>10</sub> (µg/m³) Max	**Time of Max Reading	Max Wind Speed (mph)	**Time of Max Wind Speed
<b>IMPERIAL COUNTY</b>											
Brawley-Main Street #2	ICAPCD	Hi-Vol Gravimetric	06-025-0007	(81102)	13701	-15	-	-	-	-	-
		BAM 1020					195	711	06:00		
Calexico-Ethel Street	CARB	BAM 1020	06-025-0005	(81102)	13698	3	158	626	00:00	13.1	00:00
El Centro-9th Street	ICAPCD	BAM 1020	06-025-1003	(81102)	13694	9	205	995	00:00	12.4	00:00
Niland-English Road	ICAPCD	Hi-Vol Gravimetric	06-025-4004	(81102)	13997	-57	-	-	-	16.9	05:00
		BAM 1020					206	995	00:00		
Westmorland	ICAPCD	BAM 1020	06-025-4003	(81102)	13697	-43	201	856	08:00	16.9	00:00
<b>RIVERSIDE COUNTY</b>											
Palm Springs Fire Station	SCAQMD	TEOM	06-065-5001	(81102)	33137	174	446.7	999	03:00	11	12:00
Indio (Jackson St.)	SCAQMD	TEOM	06-065-2002	(81102)	33157	1	392.7	997	02:00	11.9	01:00
<b>ARIZONA – YUMA</b>											
Yuma Supersite	ADEQ	TEOM	04-027-8011	(81102)	N/A	60	-	-	-	-	-

\*CARB = California Air Resources Board

\*ICAPCD = Air Pollution Control District, Imperial County

\*SCAQMD = South Coast Air Management Quality District

\*ADEQ = Arizona Department of Environmental Quality

\*\*Time represents the actual time/hour of the measurement in question according to the zone time (PST unless otherwise noted)  
 July 30, 2016 was not a scheduled sampling day

## II.2 Climate

As mentioned above, Imperial County is part of the Colorado Desert, which is a subdivision of the larger Sonoran Desert (**Figure 2-15**) encompassing approximately 7 million acres (28,000 km<sup>2</sup>). The desert area encompasses Imperial County and includes parts of San Diego County, Riverside County, and a small part of San Bernardino County.

**FIGURE 2-15**  
**SONORAN DESERT REGION**

The Sonoran Desert Region consists of the Sonoran Desert itself plus the surrounding biological communities, including the Sea of Cortez (Gulf of California) and its islands



**Fig 2-15:** Depicts the magnitude of the region known as the Sonoran Desert. Source: Arizona-Sonora Desert Museum at <http://desertmuseum.org/center/map.php>

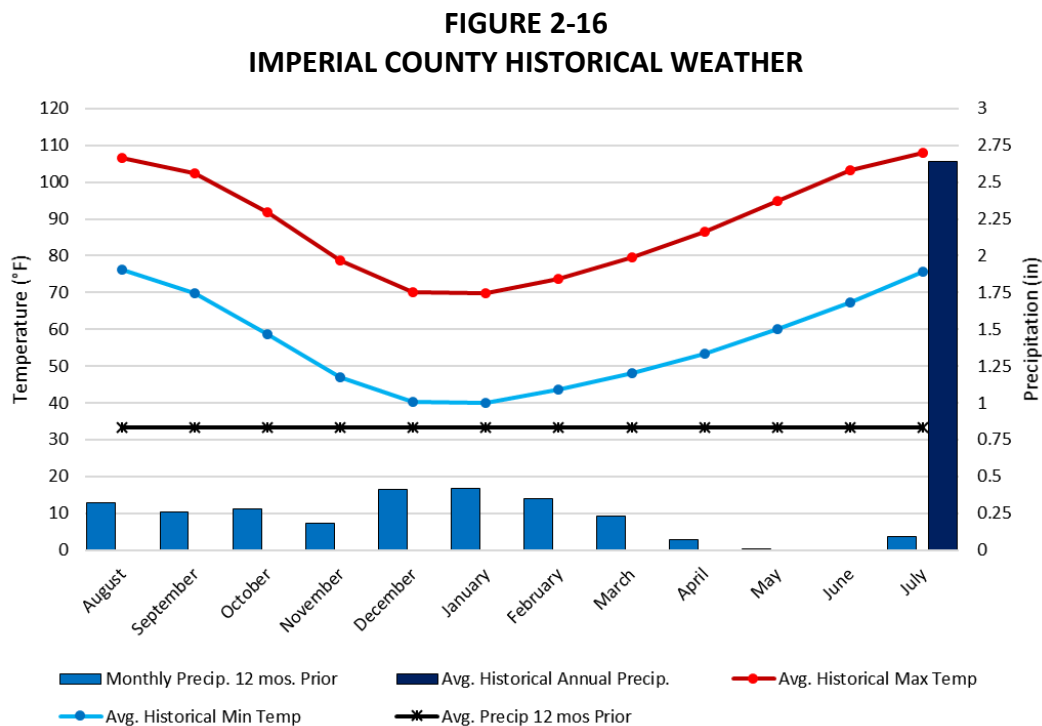
The majority of the Colorado Desert lies at a relatively low elevation, below 1,000 feet (300 m), with the lowest point of the desert floor at 275 feet (84 m) below sea level at the Salton Sea. Although the highest peaks of the Peninsular Range reach elevations of nearly 10,000 feet (3,000 m), most of the region's mountains do not exceed 3,000 feet (910 m).

In the Colorado Desert (Imperial County), the geology is dominated by the transition of the tectonic plate boundary from rift to fault. The southernmost strands of the San Andreas Fault connect to the northern-most extensions of the East Pacific Rise. Consequently, the region is subject to earthquakes, and the crust is being stretched, resulting in a sinking of the terrain over time.

The Colorado Desert's climate distinguishes it from other deserts. The region experiences greater summer daytime temperatures than higher-elevation deserts and almost never experiences frost. In addition, the Colorado Desert experiences two rainy seasons per year (in the winter and late summer), especially toward the southern portion of the region which includes a portion of San Diego County. The Colorado Desert portion of San Diego County receives the least amount of precipitation. Borrego Springs, the largest population center within the San Diego desert region averages 5 inches of rain with a high evaporation rate. By contrast, the more northerly Mojave Desert usually has only winter rains.

The west coast Peninsular Ranges, or other west ranges, of Southern California—northern Baja California, block most eastern Pacific coastal air and rains, producing an arid climate. Other short or longer-term weather events can move in from the Gulf of California to the south, and are often active in the summer monsoons. These include remnants of Pacific hurricanes, storms from the southern tropical jet stream, and the northern Inter Tropical Convergence Zone (ITCZ).

The arid nature of the region demonstrated when historic annual average precipitation levels in Imperial County average 2.64" (**Figure 2-16**). During the 12 month period prior to the July 30, 2016 event, Imperial County measured a total annual precipitation of 0.83 inches. Such arid conditions, as those preceding the event, result in soils that are particularly susceptible to particulate suspension by the elevated gusty winds.



**Fig 2-16:** In the months prior to July 30, 2016, the region suffered abnormally low total precipitation of 0.83 inches. Average annual precipitation is 2.64 inches. Meteorological data courtesy of Western Regional Climate Center (WRCC) and Weather Underground <http://www.wrcc.dri.edu/cgi-bin/climain.pl?ca2713>

The NWS explains that the speed of any wind resulting from a weather system is directly proportional to the change in air pressure, called a pressure gradient, such that when the pressure gradient increases so does the speed of the wind.<sup>4</sup> Because the pressure gradient is just the difference in pressure between high and low pressure areas, changes in weather patterns may recur seasonally.

Typically, high pressure brings clear skies and with no clouds there is more incoming shortwave solar radiation causing temperatures to rise. When surface winds become light, the cooling of the air produced directly under a high-pressure system can lead to a buildup of particulates in urban areas under an elongated region of relatively high atmospheric pressure or ridge causing widespread haze. Conversely, a trough is an elongated region of relatively low atmospheric pressure often associated with fronts. Troughs may be at the surface, or aloft under various conditions. Most troughs bring clouds, showers, and a wind shift, particularly following the passage of the trough.

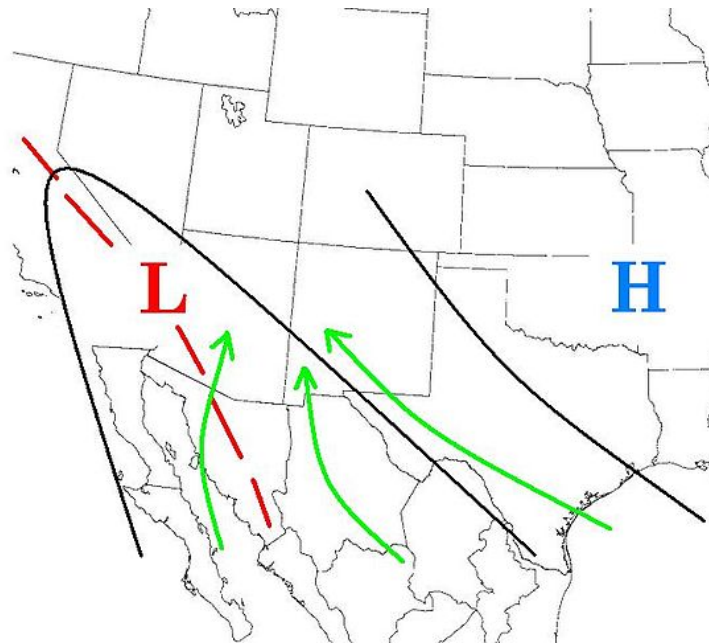
While windblown dust events in Imperial County during the fall, winter, and spring are often due to strong winds associated with low-pressure systems and cold fronts, windblown dust events during the summer monsoon season are often due to wind flow aloft from the East or South-East. This phenomenon is known as the North American Monsoon (NAM)<sup>5</sup>. The NAM occurs when there is a shift in wind patterns during the summer, which occurs as Mexico and the southwest United States warm under intense solar heating reversing airflow from dry land areas to moist ocean areas. Consequently, the prevailing winds start to flow from moist ocean areas into dry land areas (**Figure 2-17**).

---

<sup>4</sup> NWS JetStream – Origin of Wind <http://www.srh.noaa.gov/jetstream/synoptic/wind.html>

<sup>5</sup> National Weather Service document “[North American Monsoon](#)” public domain material from the NWS Forecast Office Tucson, Arizona

**FIGURE 2-17**  
**WEATHER PATTERN OF THE NORTH AMERICAN MONSOON**



**Fig 2-17:** Weather pattern of the North American Monsoon. The North American monsoon, variously known as the Southwest monsoon, the Mexican monsoon, or the Arizona monsoon is a pronounced increase in rainfall from an extremely dry June to a rainy July over large areas of the southwestern United States and northwestern Mexico. Image courtesy of Wikipedia “North American Monsoon.”

The NAM circulation typically develops in late May or early June over southwest Mexico. By mid to late summer, thunderstorms increase over the “core” region of the southwest United States and northwest Mexico<sup>6</sup>. The transport of moisture into Mexico, Arizona and the southwestern United States can come quickly and sometimes dramatically, known as “bursts” and “breaks” which can unleash violent flash floods, thousands of lightning strikes, crop-damaging hail, and walls of damaging winds and blowing dust.<sup>7</sup>

The monsoon typically arrives in mid to late June over northwest Mexico and early July over the southwest United States. While the southern areas of Mexico experience a low level monsoon circulation, transported primarily from the Gulf of California and the eastern Pacific, an upper level monsoon (or subtropical) ridge develops over the southern High Plains and northern Mexico. Thus, by late June or early July the ridge shifts into the southern Plains or southern Rockies creating less resistance for the mid and upper level moisture streams to enter the United States. If the ridge is too close to a particular area, the sinking air, at its center suppresses

<sup>6</sup> According to the NWS Tucson Arizona regional office report affected areas include the United States, Arizona, New Mexico, Sonora, Chihuahua, Sinaloa and Durango.

<sup>7</sup> 2004: The North American Monsoon. Reports to the Nation on our Changing Planet. NOAA/National Weather Service. Available on line at: [http://www.cpc.noaa.gov/products/outreach/Report-to-the-Nation-Monsoon\\_aug04.pdf](http://www.cpc.noaa.gov/products/outreach/Report-to-the-Nation-Monsoon_aug04.pdf)

thunderstorms and can result in a significant monsoon “break”. However, if the ridge sets up in a few key locations, widespread and potentially severe thunderstorms can develop.

In Imperial County, isolated thunderstorms begin to develop mainly during the hottest part of the day. The convective uplift of moist air over the hot desert landscape can produce thunderstorms, which in turn can generate gusty and highly variable winds. On occasion, a few of these thunderstorms are pushed by the winds into the lower deserts during the evening hours.

Thus, when high humid air is pushed up the Gulf of California, also known as a gulf surge the most common synoptic pattern is an easterly wave over central Mexico and an intensifying thermal low over the desert southwest. Although current studies include the relationship of gulf surges to tropical easterly and midlatitude westerly waves, additional study remains in order to understand why some gulf surges contain sufficient precipitation while others do not. Suffice to say that during the NAM season there are northward surges of relatively cool, moist maritime air from the eastern tropical Pacific into the southwestern United States via the Gulf of California (e.g. Hales 1972; Brenner 1974; Stensrud et al. 1997; Fuller and Stensrud 2000). These events are related to the amount of convective activity in northwestern Mexico and portions of the southwestern United States.<sup>8</sup>

**FIGURE 2-18**  
**CONCEPTUAL DIAGRAM OF GULF SURGE TRIGGER**



**Fig 2-18:** A conceptual diagram of how a tropical system can trigger a gulf surge. Source: Gulf of California moisture surge Wikipedia The Free Encyclopedia  
[https://en.wikipedia.org/wiki/Gulf\\_of\\_California\\_moisture\\_surge](https://en.wikipedia.org/wiki/Gulf_of_California_moisture_surge)

<sup>8</sup> Relationships Between Gulf of California Moisture Surges and Precipitation in the Southwestern United States, R.W. Higgins, W. Shi and C. Hain, Climate Prediction Center, NOAA/NWS/NCEP February 2004 (Journal of Climate – in Press)  
<https://www.eol.ucar.edu/projects/name/documentation/hsh04.pdf>

### II.3 Event Day Summary

The exceptional event for July 30, 2016, caused by the intrusion of monsoonal moisture that moved into the desert southwest, evolved into a very active, high impact weather situation across Arizona and California. Both the Phoenix and San Diego NWS offices were in anticipation of afternoon and evening thunderstorms as a moist southeasterly flow, maintained by a large inverted trough traveling through Mexico, which reached the west coast, entered the Sierra Madre Occidental Friday, July 29, 2016. The outflow winds from these thunderstorms initiated a “gulf surge” Friday, July 29, 2016 into Saturday, July 30, 2016.<sup>9</sup> By early Friday, July 29, 2016 the NWS in Phoenix described the expected storms as efficient wind producers causing large areas of the desert to experience outflow winds. As a result, the Phoenix NWS office issued several Urgent Weather Messages, Special Weather Statements, Bulletins and other forms of advisories warning of reduced visibility due to blowing dust. By 308 am PST (408 am PDT) Saturday, July 30, 2016 the San Diego NWS office described a thunderstorm complex over southwest and south central Arizona Friday evening that pushed an outflow boundary across the lower deserts by midnight. The San Diego office described the outflow boundary as pushing what would have been an impressive haboob across the lower deserts under the cover of darkness, identifying wind gusts less than 50 mph across Imperial County but near 90 mph at Gila Bend, about 100 due east of the CA-AZ border.<sup>10</sup> Indicating the movement of the system in a northwest direction from Mexico. Finally, the San Diego NWS office similarly identified reduced visibility in El Centro, Thermal and Palm Springs.

On July 30, 2016, strong southerly winds, associated with outflow boundary winds transported windblown dust emissions from areas as far south as northeastern Mexico affecting areas in Arizona, Yuma, Thermal and Imperial County and causing an exceedance at all five air monitors in Imperial County.

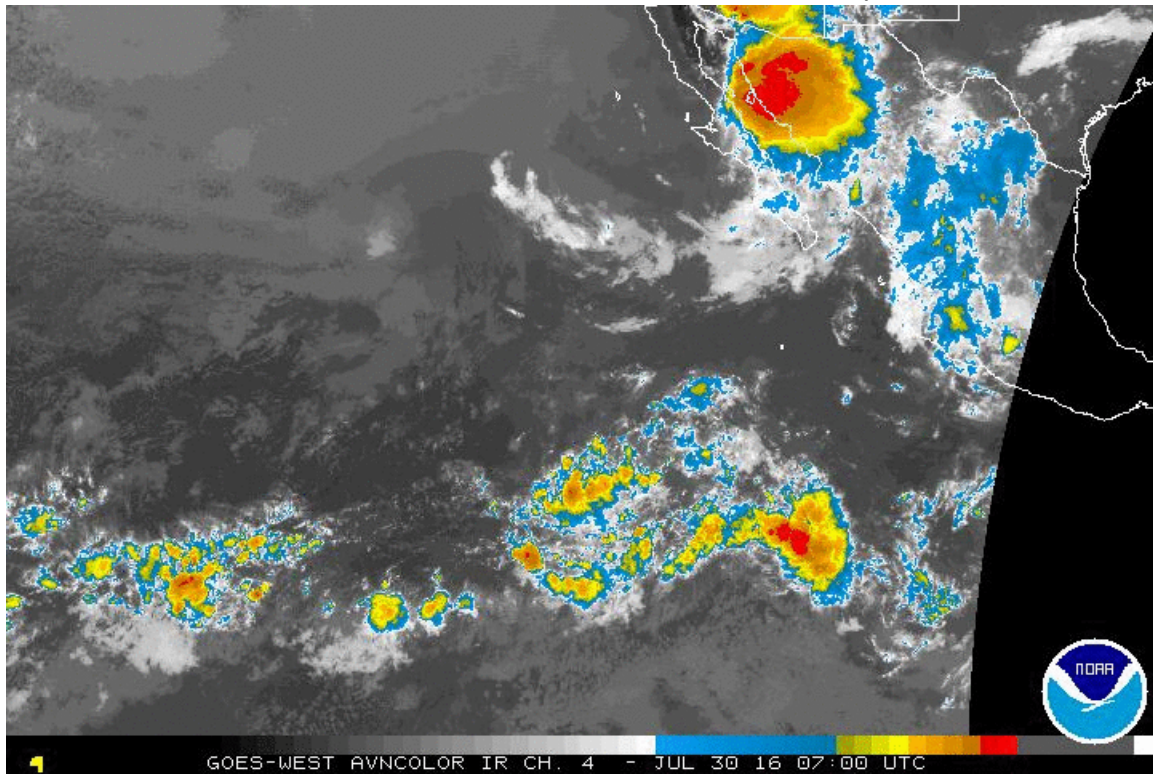
**Figures 2-19 through 2-23** provide information regarding the meteorological conditions and resulting winds speeds that allowed for increased moisture to move into the Desert Southwest Friday, July 29, 2016 causing an increase in thunderstorm activity during the evening hours of July 29, 2016 through Saturday, July 30, 2016. Outflow boundaries associated with the very active, high impact weather caused strong and gusty winds across southeastern California and Arizona.

---

<sup>9</sup> Area Forecast Discussions for San Diego issued 710 pm PST (810 pm PDT) and Phoenix issued 725 pm MST (825 pm PST), Thursday July 28, 2016.

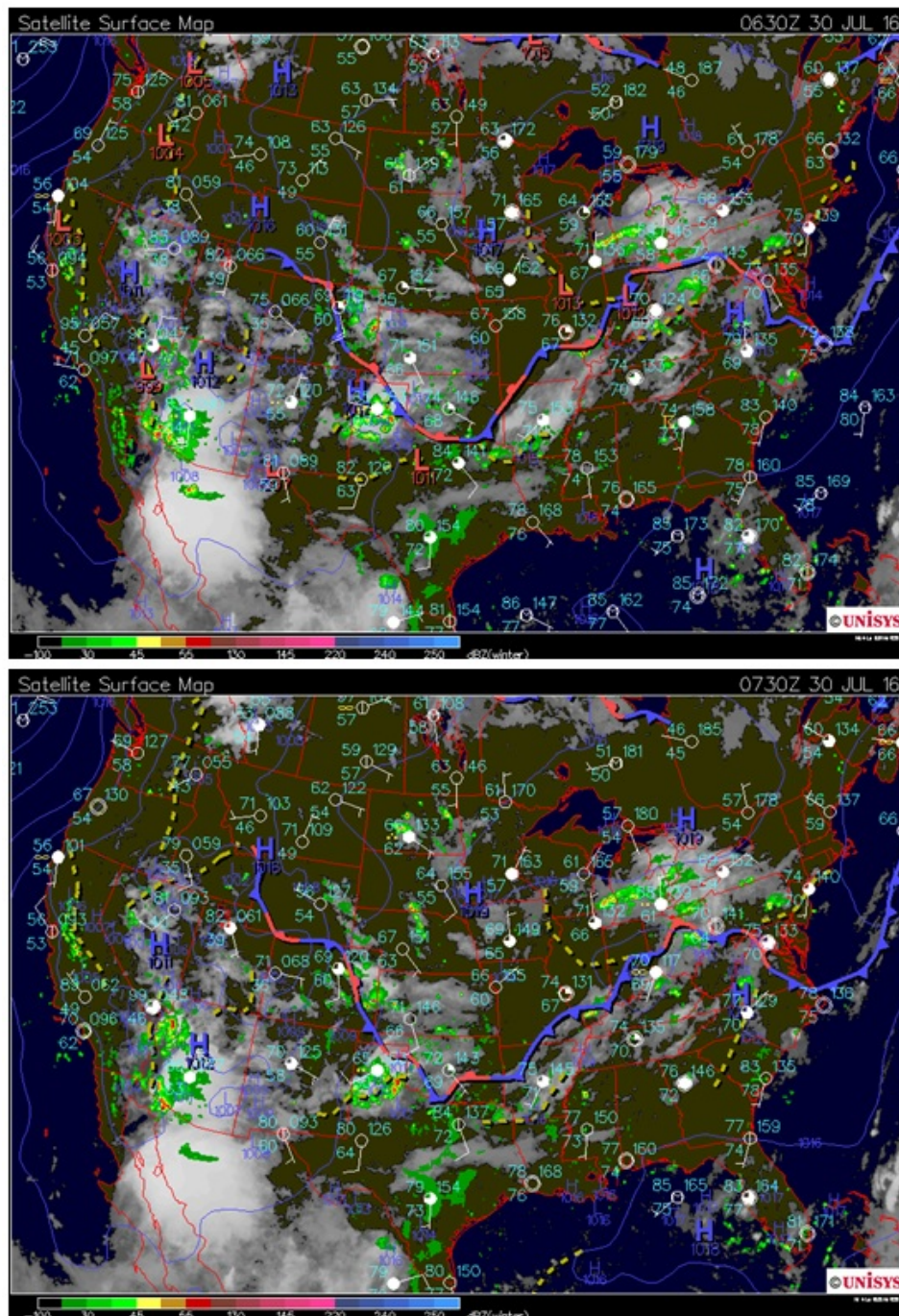
<sup>10</sup> Area Forecast Discussion, National Weather Service San Diego CA, 308am PST (408 am PDT) Saturday, July 30, 2016.

**FIGURE 2-19**  
**MONSOONAL AIR MASS SURGES NORTH JULY 29, 2016**



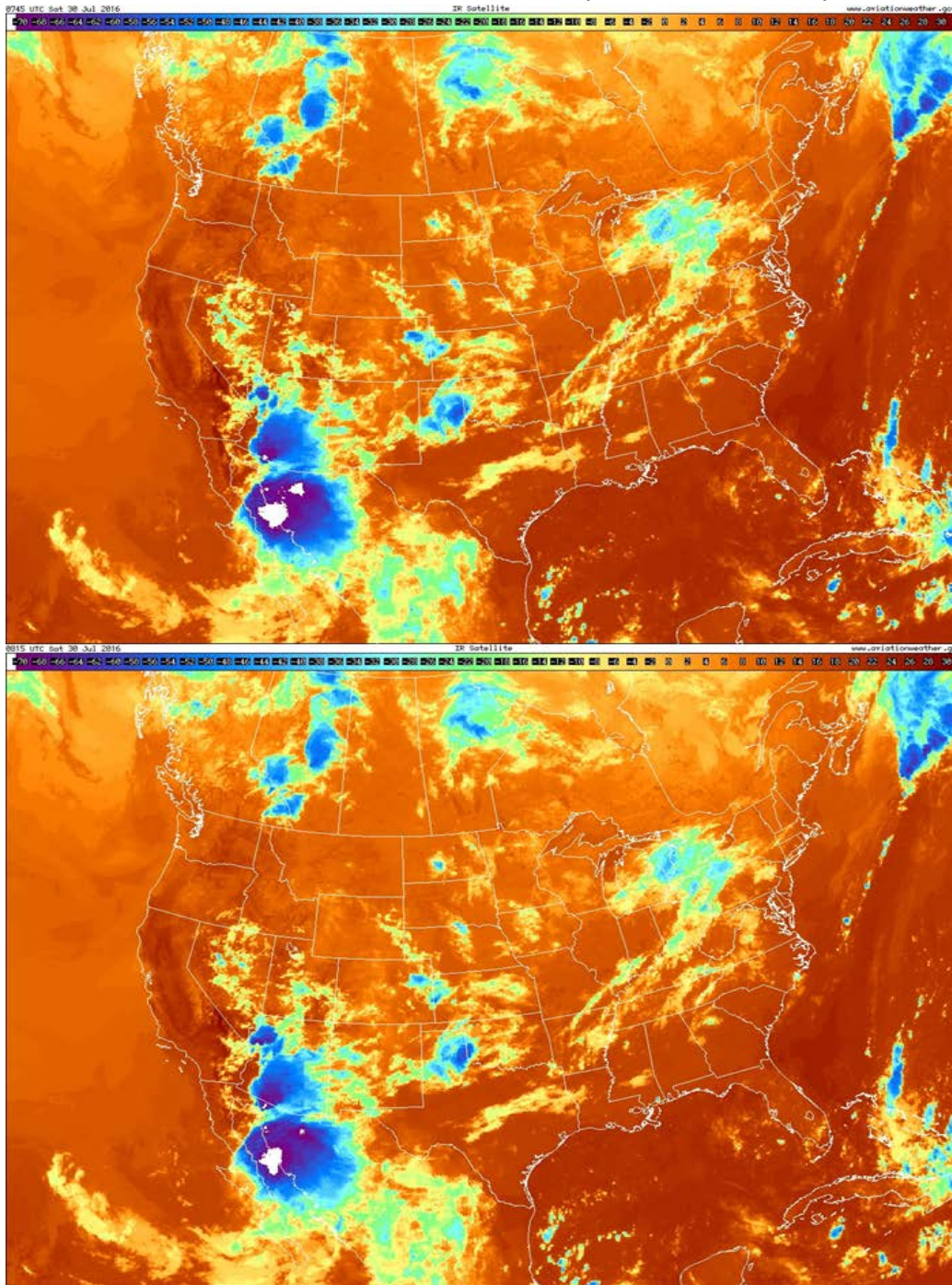
**Fig 2-20:** GOES-WEST image captured July 29, 2016 at 2300 identifies the storm cells approaching Arizona from Mexico. The NotiCalifornia article found in **Appendix A** describes the forecast for the populations of the State of Baja California Sur. Source: NotiCalifornia forecast for July 30, 2016

**FIGURE 2-20**  
**MONSOONAL SYSTEM DOMINATES THE SOUTHWEST**



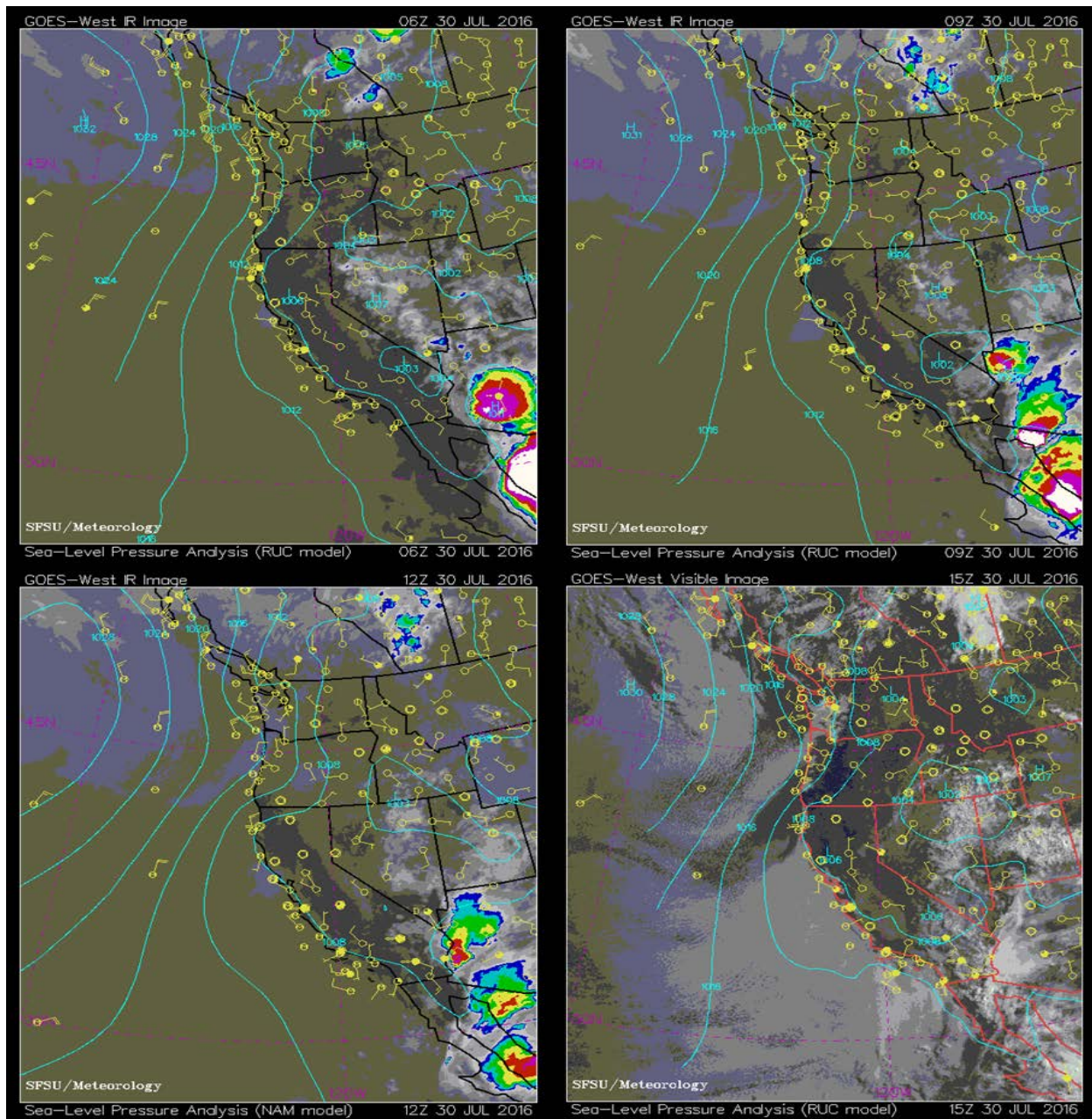
**Fig 2-20:** Two satellite surface composite images captured July 29, 2016 at 2230 PST (top) and 2330 PST (bottom) identify storm cells approaching the CA-AZ-MX border. Source: UNISYS and <http://www2.mmm.ucar.edu/imagearchive/index.html>

**FIGURE 2-21**  
**MONSOONAL AIR DRAWS CLOSER JULY 29, 2016 AND JULY 30, 2016**



**Fig 2-21:** A pair of CONUS infrared images show the monsoonal air mass intruding into Southwest United States as it moved northward out of Mexico at 1545 on July 29, 2016 (top) and 1615 on July 30, 2016 (bottom). Bluish colors indicate cooler clouds with convective potential. Deep outflow boundaries and numerous collisions were sufficient to cause additional convection helping to re-enforce strong surface winds that led to dense blowing dust. Source: Aviationweather.gov

**FIGURE 2-22**  
**PROGRESSION OF MONSOONAL SYSTEM**



**Fig 2-22:** Four GOES-W visible and infrared satellite images show the progression of the monsoonal system northward. The first image (top left) shows the monsoonal system at 2200 PST July 29, 2016. At 0100 PST on July 30, 2016 (top right) wind barbs indicate winds of at least 23 mph across southeastern California however actual measured winds at local airports in Yuma AZ MCAS (KNYL), EL Centro NAF (KNJK), and Imperial County Airport (KIPL) were stronger. Top left 2200 PST July 29, 2016. Top right 0100 July 30, 2016. Bottom left 0400 July 30, 2016 and bottom right 0700 July 30, 2016. Source: SFSU Department of Earth & Climate Sciences and the California Regional Weather Server. [http://squall.sfsu.edu/crws/archive/wcsathts\\_arch.html](http://squall.sfsu.edu/crws/archive/wcsathts_arch.html)

**FIGURE 2-23**  
**MONSOONAL AIR MASS SURGES NORTH JULY 30, 2016**



**Fig 2-23:** The MODIS instrument onboard the Aqua satellite captured the clouds associated with the weather system at 1330 PST on July 30, 2016. Source: MODIS Today

As mentioned above, the Phoenix and San Diego NWS offices were in anticipation of afternoon and evening thunderstorms affecting the region as early as Friday, July 29, 2016. The San Diego NWS office discussed intrusion of monsoonal moisture, as early as Thursday July 28, 2016. The discussions identified thunderstorm activity in Nevada, Arizona and Baja Mexico. The Phoenix NWS office identified thunderstorm activity along Gila County in Arizona days prior to Saturday, July 30, 2016. Both NWS offices expected the large inverted trough that developed over Mexico to provide the conditions favorable for moist southeasterly flow that would allow a more humid airmass to move into the Desert Southwest during the weekend. As a result, the Phoenix NWS office issued 19 different types of notices including Urgent Weather Messages, Special Weather Statements, Bulletins, and Watch Notifications as well as Preliminary Storm reports. These messages all warned of dense and widespread blowing dust created by the outflow winds associated with the very active convection where thunderstorm outflows moved from Arizona to California.

Unfortunately, the Phoenix NWS office concentrated much of the area discussions and analysis within the Phoenix area with a brief mention of Yuma from time to time. By contrast, the San Diego NWS office followed the progression of the thunderstorm complex over southwest and south central Arizona. The July 30, 2016 area forecast discussion released, during the early am hours, by the San Diego NWS office described the movement of the outflow boundary created by the active convective complex across the lower deserts at midnight affecting Imperial County, the Coachella Valley and the San Diego County deserts. The area forecast discussion described reduced visibilities in El Centro, Thermal and Palm Springs due to blowing dust.

By mid-morning July 30, 2016, the area forecast discussion released by the San Diego NWS described the effects of the thunderstorm complex that collapsed over southwestern Arizona as still affecting the region, especially in the lower deserts. The San Diego NWS office explained that blowing dust and sand continued to reduce visibility within the lower deserts. The discussion continued to explain that the thunderstorm complex moved to the southwest over northern Baja allowing for the potential for more widespread thermally driven showers/thunderstorms in the mountains and desert slopes during the afternoon hours. The identified caveat was the presence of moisture debris clouds that would potentially inhibit the afternoon heating thus reducing the potential for thunderstorm activity during the afternoon to evening hours.

By the afternoon hours of July 30, 2016, the San Diego NWS office released an area discussion describing the potential for isolated and scattered thunderstorms over the mountains, at higher elevations, primarily in Riverside and San Bernardino Counties. This would affirm the movement of the complex away from Imperial County and into the coastal mountains to the northwest. By late afternoon around 318pm PST (418pm PDT) the San Diego NWS office released a Public Information Statement of widespread dust and very unhealthy to hazardous air quality conditions over the deserts, lower mountain slopes and valleys where members of the public and media reported dust in the air. The San Diego NWS office referred the public to the South Coast Air Quality Management District and the San Diego Air Pollution Control District for additional information.<sup>11</sup>

Locally, all airports, including the Yuma MCAS (KNYL) and Mexicali International Airport all measured elevated gusty winds during the evening hours of July 29, 2016 through the morning hours of July 30, 2016. Powerful gusts reaching 40 mph were measured at both KIPL and KNJK in the final hours of July 29, with slightly less gusty winds during the first hour of July 30. KNYL reported a dust storm at 2257 PST (2357 MST) on July 29, 2016. The Mexicali airport reported multiple incidents of blowing dust starting at 2340 PST July 29, 2016. **Figure 2-24** depicts the ramp-up analysis for July 30, 2016 providing a visual depiction of the meteorological conditions that existed when an expected intrusion of monsoonal air resulted in an active convective complex over southwest and south central Arizona that moved west towards San Diego and through Imperial County.

---

<sup>11</sup> Public Information Statement; National Weather Service San Diego CA; 418 pm PDT (318 pm PST) Saturday, July 30, 2016

**FIGURE 2-24**  
**RAMP UP ANALYSIS JULY 30, 2016**



**Fig 2-24:** Gusty winds from outflow boundaries associated with the very active convection that produced thunderstorm outflows moved from Mexico into Arizona and towards California. The outflow winds created what the San Diego NWS office described as an “impressive haboob” under the cover of darkness, as the windblown dust travelled towards Imperial County during the pre-dawn hours of July 30, 2016 (beginning potentially at midnight) through the morning hours of July 30, 2016. As a result, all five air monitors in Imperial County exceeded the NAAQS. Base map from Google Earth

**Table 2-4** contains a summary of maximum winds, peak wind gusts, and wind direction at monitors in Imperial County, eastern Riverside County, Yuma County, Arizona, and Mexicali. For detailed meteorological station, graphs see **Appendix B**.

**TABLE 2-2**  
**WIND SPEEDS ON JULY 30, 2016**

Station Monitor	Maximum Wind Speed (WS) (mph)	Wind Direction during Max WS (degrees)	Time of Max Wind Speed	24 hr Maximum Wind Gust (WG) (mph)	Time of Max WG	PM <sub>10</sub> correlated to time of Max Wind Speed				
Airport Meteorological Data						Brly	CX	EC	NInd	Wstmld
<b>IMPERIAL COUNTY</b>										
Imperial Airport (KIPL)	28	160	2:53	36	2:53	567	539	506	-	453
Naval Air Facility (KNJK)	28	120	0:28	37	0:28	-	626	995	995	-
Calexico (Ethel St)	13.1	118	0:00	-	-	-	626	995	995	-
El Centro (9th Street)	12.4	120	0:00	-	-	-	626	995	995	-
Niland (English Rd)	21.2	114	0:00	-	-	-	626	995	995	-
Westmorland	16.9	124	0:00	-	-	-	626	995	995	-
<b>RIVERSIDE COUNTY</b>										
Blythe Airport (KBLH)	22	170	4:52	31	4:52	432	113	219	485	371
Palm Springs Airport (KPSP)	18	100	11:53	25	11:53	136	173	272	143	175
Jacqueline Cochran Regional Airport (KTRM) - Thermal	21	140	2:04	29	0:52	567	539	506	-	453
<b>ARIZONA - YUMA</b>										
Yuma MCAS (KNYL)	25	200	3:31	38	3:31	509	481	252	571	383
<b>MEXICALI - MEXICO</b>										
Mexicali Int. Airport (MXL)	31.1	90	0:13	-	-	-	626	995	995	-

\*All time referenced throughout this document is in Pacific Standard Time (PST) unless otherwise noted

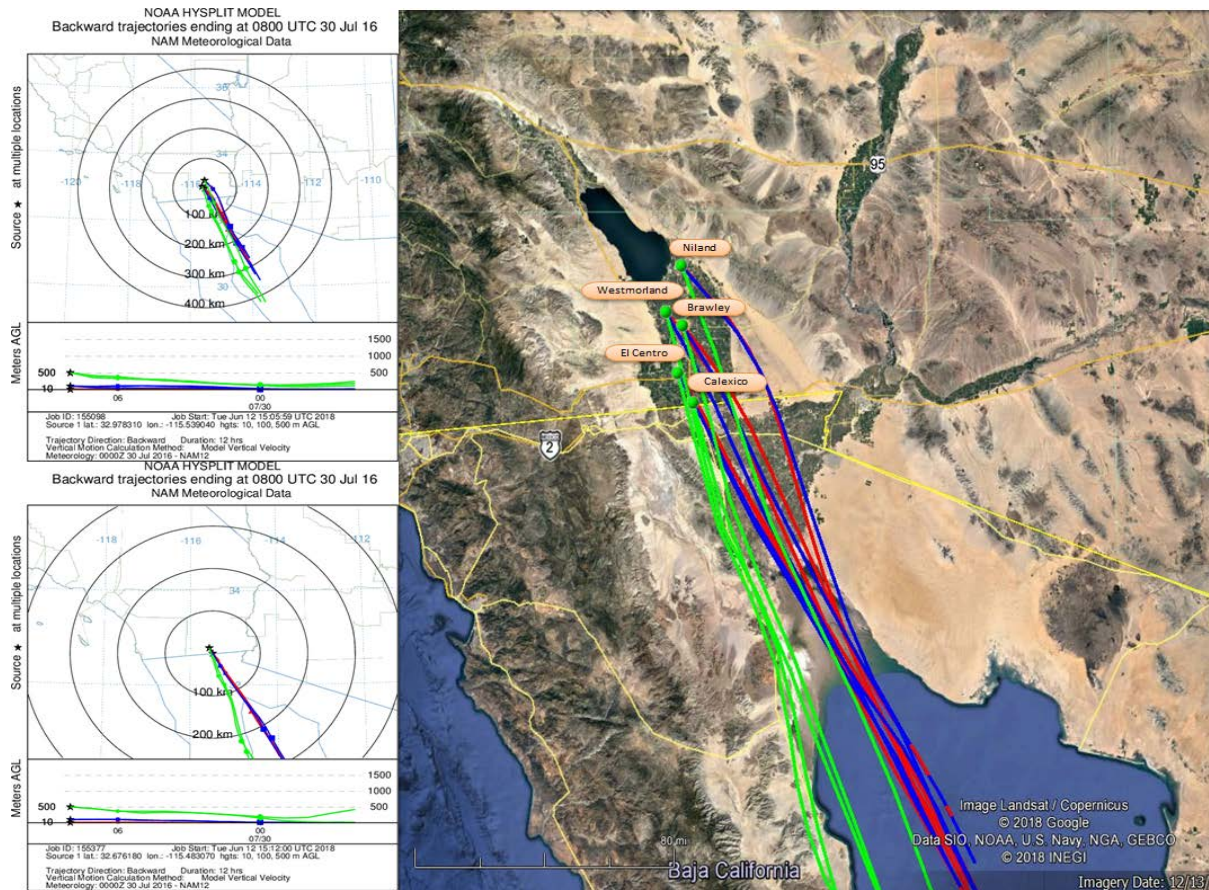
The National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory HYSPLIT back trajectory model,<sup>12</sup> depicted in **Figures 2-25 and 2-26** depict the general path of airflow 12 hours prior to 0000 PST and 1200 PST on July 30, 2016. The ending hour of 0000 PST is coincident with measured hourly peak concentrations and the at the Calexico, El Centro and Niland monitors. The ending hour of 1200 PST is coincident with the last measured concentrations at or above 100 µg/m<sup>3</sup> and reduced wind speeds. Both the Brawley and Westmorland monitors failed to meet critical criteria requirements for flow at the 0000 PST hour, which caused the invalidation of the hourly concentration. Absent the invalidation of the data at both the Brawley and Westmorland monitors, more likely than not the monitors would have measured peak concentrations.

As mentioned above, on July 30, 2016 during the early morning hours the San Diego NWS office described what must have been an impressive “haboob” moving across the lower deserts under the cover of darkness around midnight. The winds associated with the outflow boundary

<sup>12</sup> The Hybrid Single Particle Lagrangian Integrated Trajectory Model (**HYSPLIT**) is a computer model that is a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. It is currently used to compute air parcel trajectories and dispersion or deposition of atmospheric pollutants. One popular use of HYSPLIT is to establish whether high levels of air pollution at one location are caused by transport of air contaminants from another location. HYSPLIT's back trajectories, combined with satellite images (for example, from NASA's [MODIS](#) satellites), can provide insight into whether high air pollution levels are caused by local air pollution sources or whether an air pollution problem was blown in on the wind. The initial development was a result of a joint effort between NOAA and Australia's Bureau of Meteorology. Source: NOAA/Air Resources Laboratory, 2011.

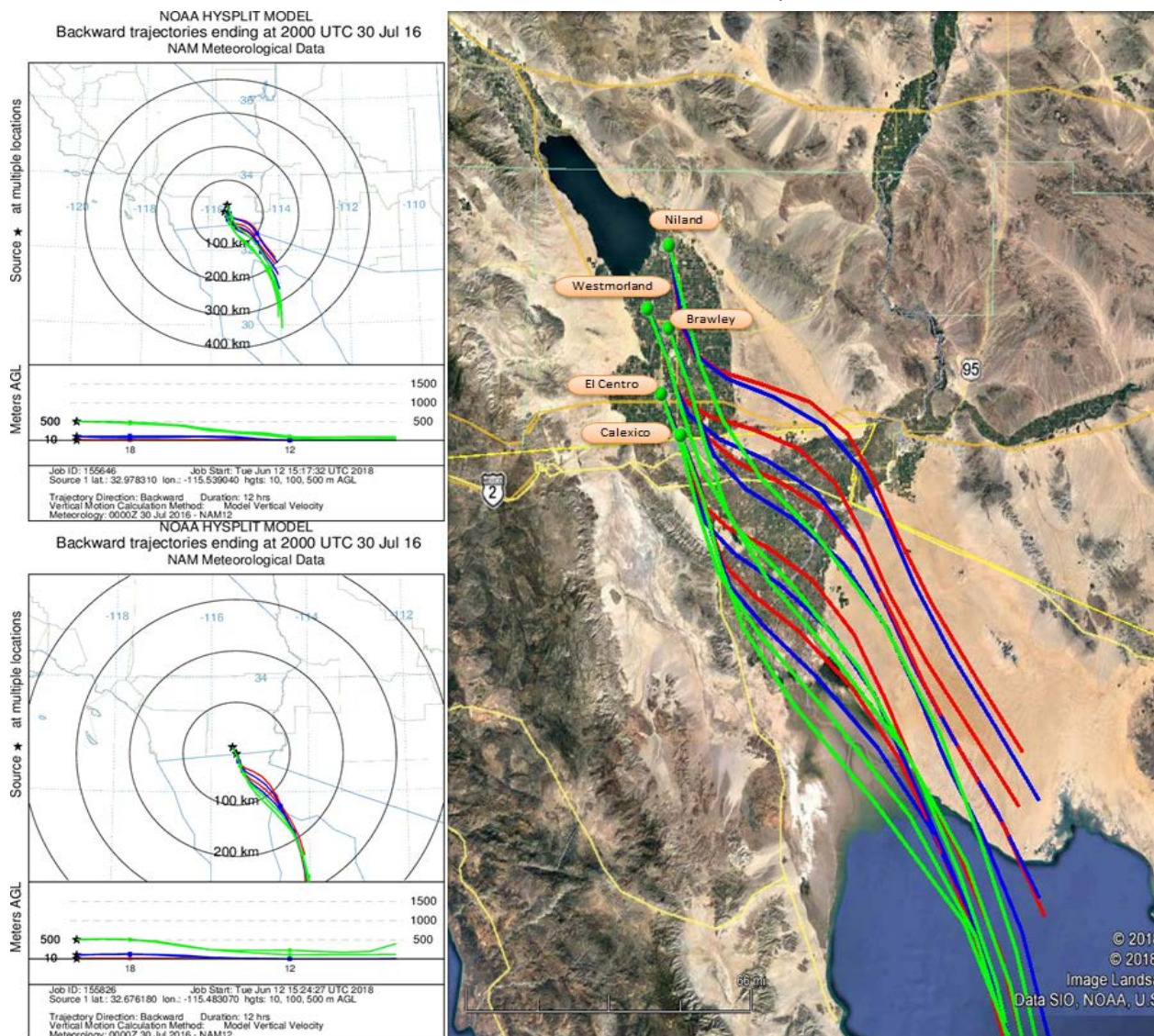
measured 90 mph at Gila Bend, less than 50 mph across Imperial County and less than 40 mph within the Coachella Valley and San Diego County deserts. All five air monitors in Imperial County exceeded the NAAQS when measured concentrations above  $100 \mu\text{g}/\text{m}^3$  where measured between the hours of 0000 PST and 1300 PST. As the convection complex moved towards the northwest leaving Mexicali and Imperial County, the San Diego, Riverside and San Bernardino mountains were affected during the afternoon hours of July 30, 2016. Airflow is distinctly from the south at all monitors. The surface level airflow is evident for all of the 12 hours prior to 0000 PST July 30, 2016 coincident with elevated wind speeds and wind gusts at the Imperial County airport (KIPL) and the El Centro Naval Air Facility (KNJK). Data used in the HYSPLIT model has a horizontal resolution of 12 km and is integrated every three hours. Thus, the HYSPLIT model may differ from local observed surface wind speeds and directions.

**FIGURE 2-25**  
**HYSPLIT MODEL ENDING 0000 JULY 30, 2016**



**Figure 2-25:** 12-hour back-trajectory ending at Calexico, El Centro, Brawley, Westmorland, and Niland at 0000 July 30, 2016 illustrates the path of airflow over natural open desert areas, farmland and populated regions within northern Mexico before reaching the monitors in Imperial County. Red trajectory indicates airflow at 10 meters AGL (above ground level); blue indicates airflow at 100 m; green indicates airflow at 500m. Yellow line indicates the international border. Aqua lines denote county boundaries. Dynamically generated through NOAA's Air Resources Laboratory HYSPLIT model. Base map from Google Earth

**FIGURE 2-26**  
**HYSPLIT MODEL ENDING 1200 JULY 30, 2016**



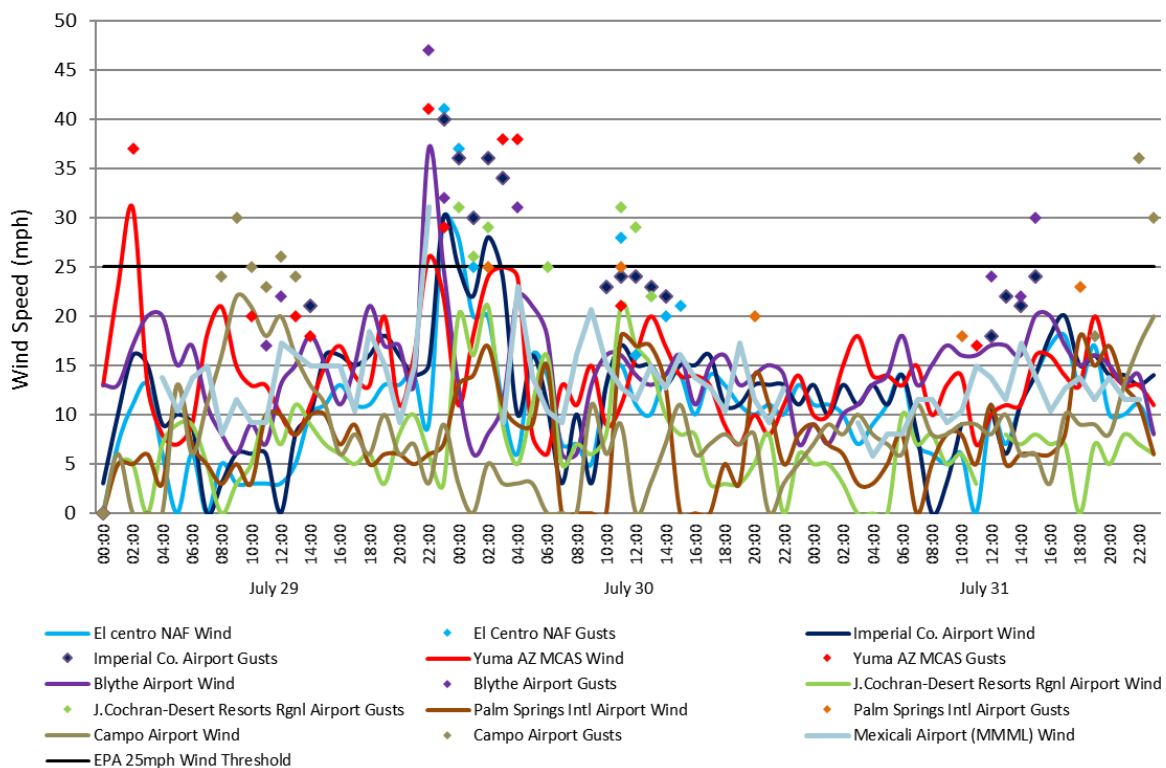
**Figure 2-26:** 12-hour back-trajectory ending at Calexico, El Centro, Brawley, Westmorland, and Niland at 1200 July 30, 2016 illustrates the path of airflow over natural open desert areas, farmland and populated regions within northern Mexico before reaching the monitors in Imperial County. The 1200 PST hour is coincident with the last measured concentration at or above  $100 \mu\text{g}/\text{m}^3$  and reduced wind speeds. Red trajectory indicates airflow at 10 meters AGL (above ground level); blue indicates airflow at 100 m; green indicates airflow at 500m. Yellow line indicates the international border. Aqua lines denote county boundaries. Dynamically generated through NOAA's Air Resources Laboratory HYSPLIT model. Base map from Google Earth

**Figures 2-27 and 2-28** illustrate the elevated wind speeds and elevated levels of hourly  $\text{PM}_{10}$  concentrations measured in Riverside, Imperial and Yuma Counties for three days, July 29, 2016 through July 31, 2016. Elevated dust emissions transported into Imperial County affected all the

air monitors in Imperial County when outflow boundaries associated with the very active, high impact weather caused strong and gusty winds across southeastern California and Arizona. Measured wind speeds above 25 mph are coincident with elevated measured hourly concentrations of PM<sub>10</sub>.

The resulting entrained dust and accompanying high winds from the system qualify this event as a “high wind dust event”.<sup>13</sup> High wind dust events are considered natural events where the windblown dust is either from solely a natural source or from areas where anthropogenic sources of windblown dust are controlled with Best Available Control Measures (BACM). The following sections provide evidence that the July 30, 2016 high wind event qualifies as a natural event and that BACM was overwhelmed by the suddenness and intensity of the meteorological event.

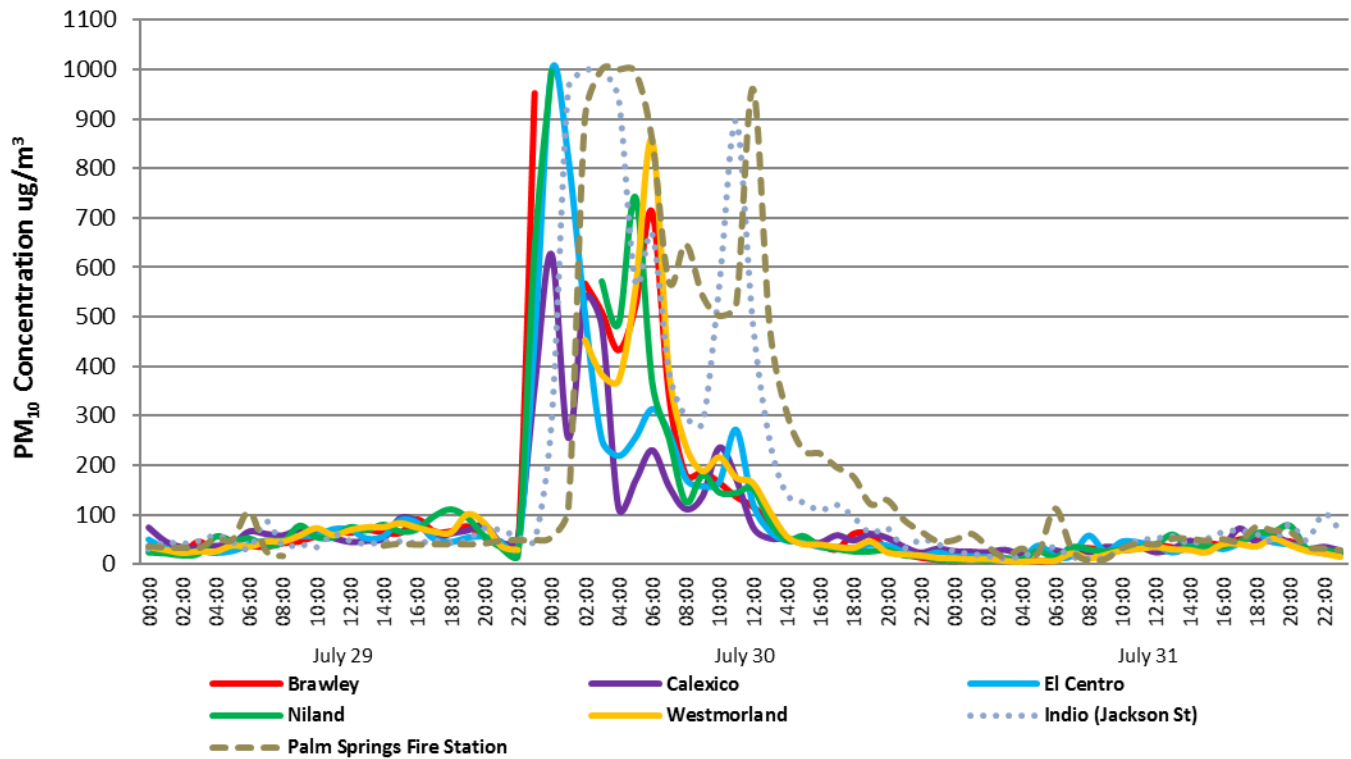
**FIGURE 2-27**  
**72 HOUR WIND SPEEDS AT REGIONAL AIRPORTS**



**Fig 2-27:** Is the graphical representation of the 72 hour measured winds speeds and gusts at regional airports in California and Arizona. The graph illustrates the regional effect of the wind event and the number of hours where measured wind speeds and wind gusts where above 25 mph. Wind Data from the NCEI’s QCLCD system

<sup>13</sup> Title 40 Code of Federal Regulations part 50: §50.1(p) High wind dust event is an event that includes the high-speed wind and the dust that the wind entrains and transports to a monitoring site.

**FIGURE 2-28**  
**72-HOUR PM<sub>10</sub> CONCENTRATIONS AT VARIOUS SITES**



**Fig 2-28:** Is the graphical representation of the 72 hour relative PM<sub>10</sub> concentrations at various sites in California and Arizona. The elevated PM<sub>10</sub> concentrations at all sites on July 30, 2016, demonstrates the regional effect of the weather system and accompanying winds. Air quality data from the EPA's AQS data bank

### III Historical Concentrations

#### III.1 Analysis

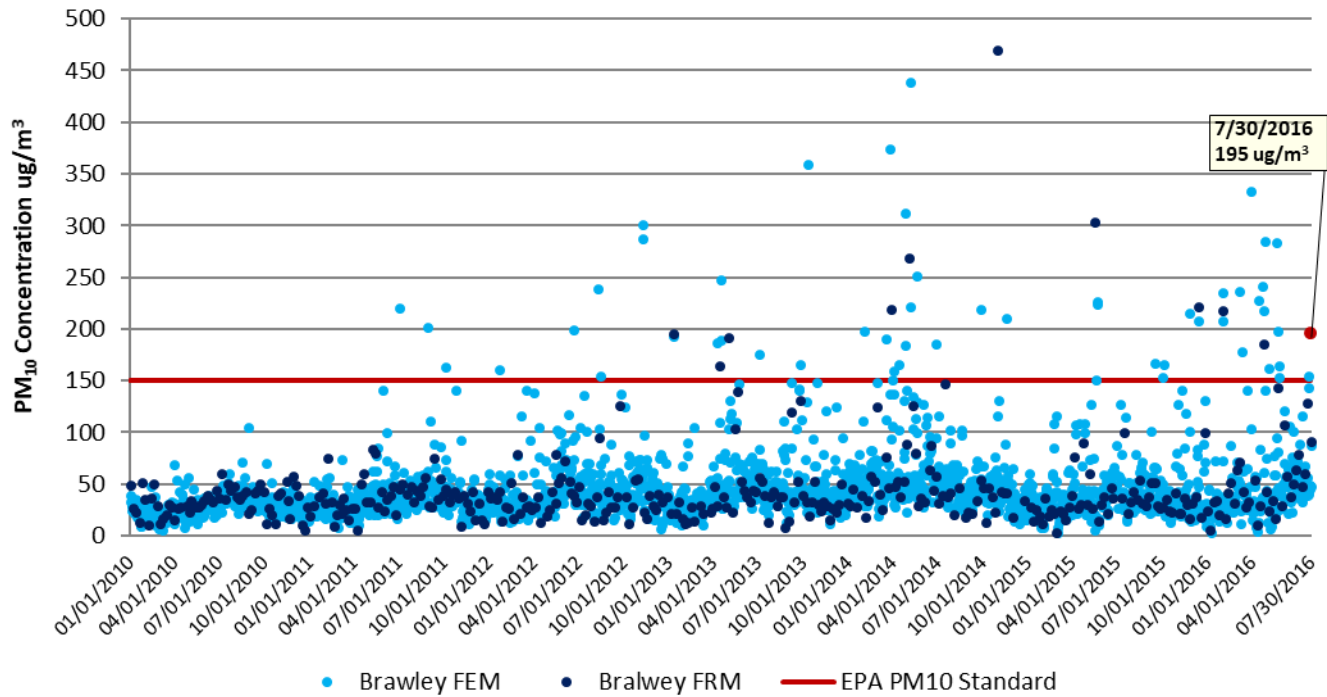
While naturally occurring high wind events may recur seasonally and at times frequently and qualify for exclusion under the EER, historical comparisons of the particulate concentrations and associated winds provide insight into the frequency of events within an identified area. The following time series plots illustrate that PM<sub>10</sub> concentrations measured at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors on July 30, 2016, were compared to non-event and event days demonstrating the variability over several years and seasons. The analysis, also, provides supporting evidence that there exists a clear causal relationship between the July 30, 2016 high wind event and the exceedance measured at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors.

**Figures 3-1 through 3-10** show the time series of available FRM and BAM 24-hr PM<sub>10</sub> concentrations at the Brawley, Calexico, El Centro, Niland and Westmorland monitors for the period of January 1, 2010 through July 30, 2016. Note that prior to 2013, non-regulatory continuous BAM data was not reported into the AQS.<sup>14</sup> The use of time-series data graphs compiled and plotted 24-hour averaged PM<sub>10</sub> concentrations between January 1, 2010 and July 24, 2016, help to establish the variability of the event as it occurred on July 30, 2016. Although the discontinuation of FRM sampling at the El Centro and Westmorland monitors had an effective date of December 31, 2015 FEM sampling commenced July 15, 2015 at both the El Centro and Westmorland stations. Similarly, FRM sampling in Calexico was discontinued January 19, 2016. In any event, all ten figures illustrate that the exceedance, which occurred on July 30, 2016, were outside the normal historical concentrations when compared to event and non-event days. Air quality data for all graphs obtained through the EPA's AQS data bank.

---

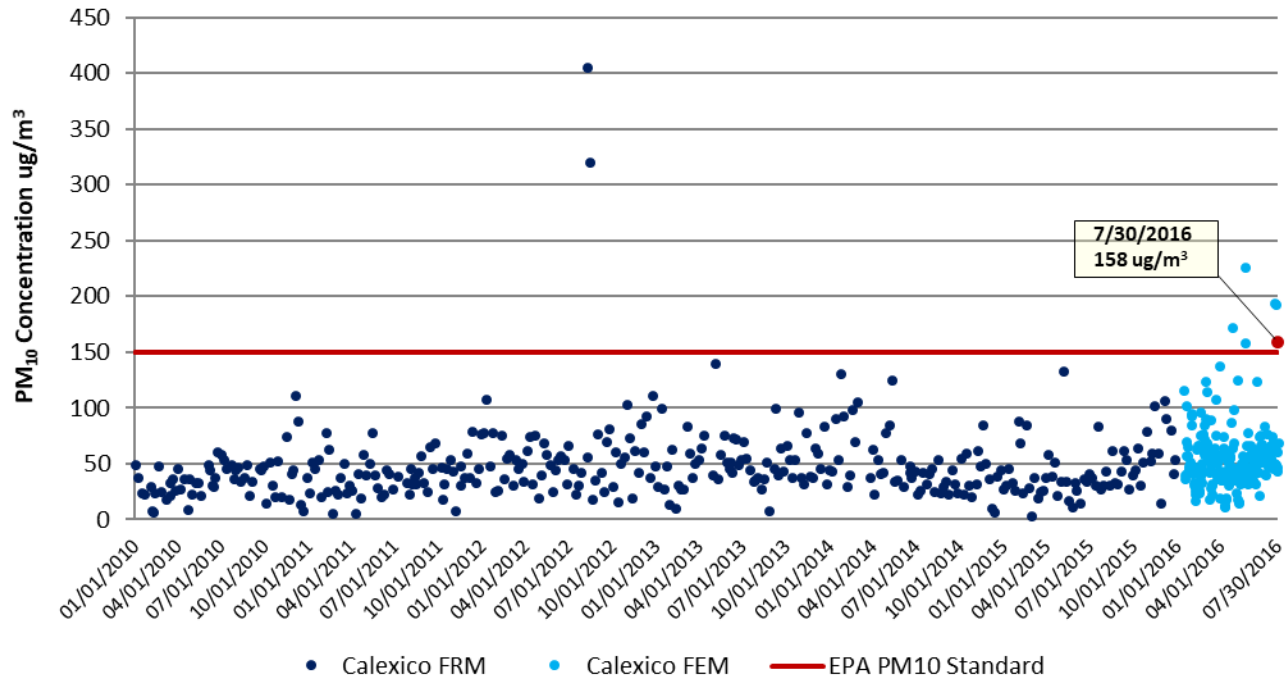
<sup>14</sup> Pollutant concentration data contained in EPA's Air Quality System (AQS) are required to be reported in units corrected to standard temperature and pressure (25 C, 760 mm Hg). Because the PM<sub>10</sub> concentrations prior to 2013 were not reported into the AQS database all BAM (FEM) data prior to 2013 within this report are expressed as micrograms per cubic meter (mg/m<sup>3</sup>) at local temperature and pressure (LTP) as opposed to standard temperature and pressure (STP, 760 torr and 25 C). The difference in concentration measurements between standard conditions and local conditions is insignificant and does not alter or cause any significant changes in conclusions to comparisons of PM<sub>10</sub> concentrations to PM<sub>10</sub> concentrations with in this demonstration.

**FIGURE 3-1**  
**BRAWLEY HISTORICAL**  
**FRM AND FEM PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**JANUARY 1, 2010 TO JULY 30, 2016**

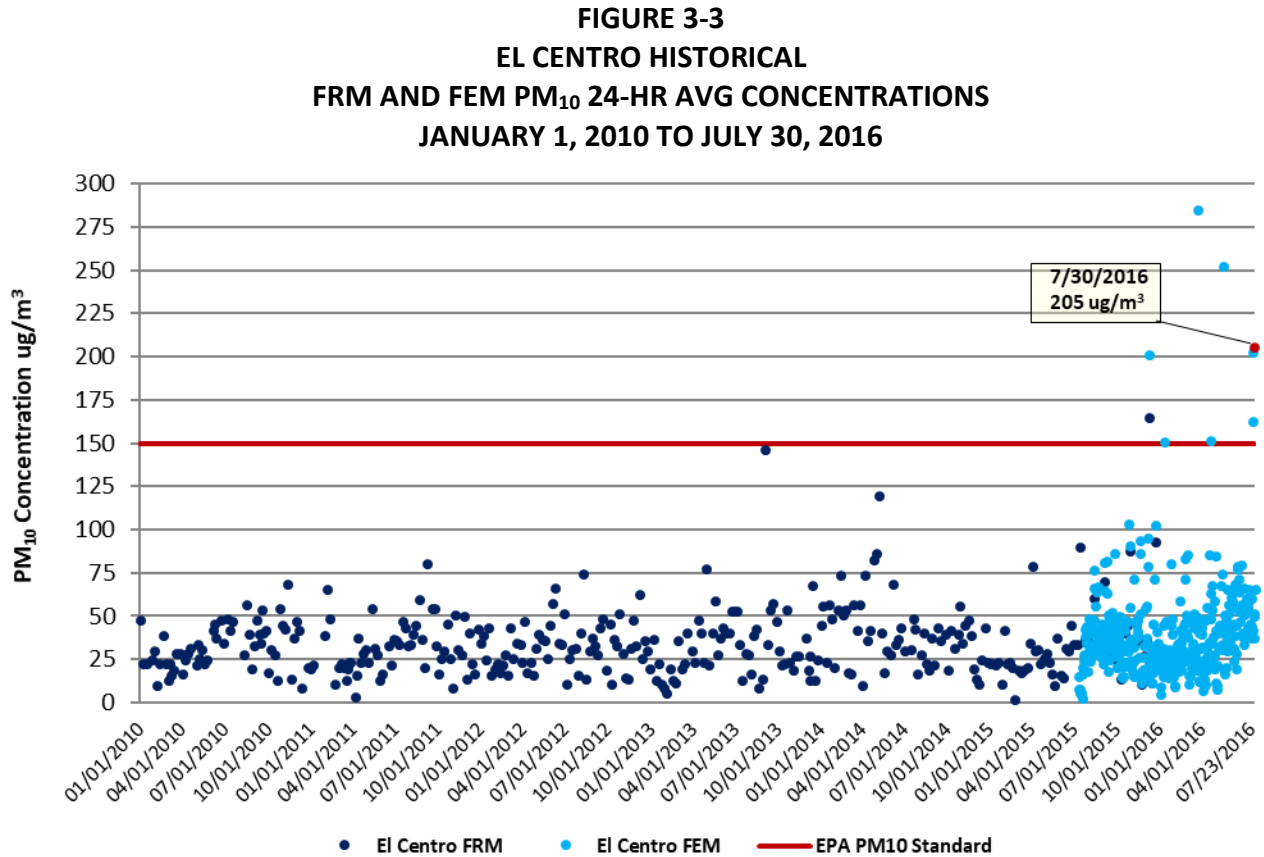


**Fig 3-1:** A comparison of PM<sub>10</sub> historical concentrations demonstrates that the measured concentration of 195  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Brawley monitor was outside the normal historical concentrations when compared to similar days and non-event days. Of the 2,403 sampling days, there were 53 exceedance days, which is less than a 2.5% occurrence rate

**FIGURE 3-2**  
**CALEXICO HISTORICAL**  
**FRM AND FEM PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**JANUARY 1, 2010 TO JULY 30, 2016**

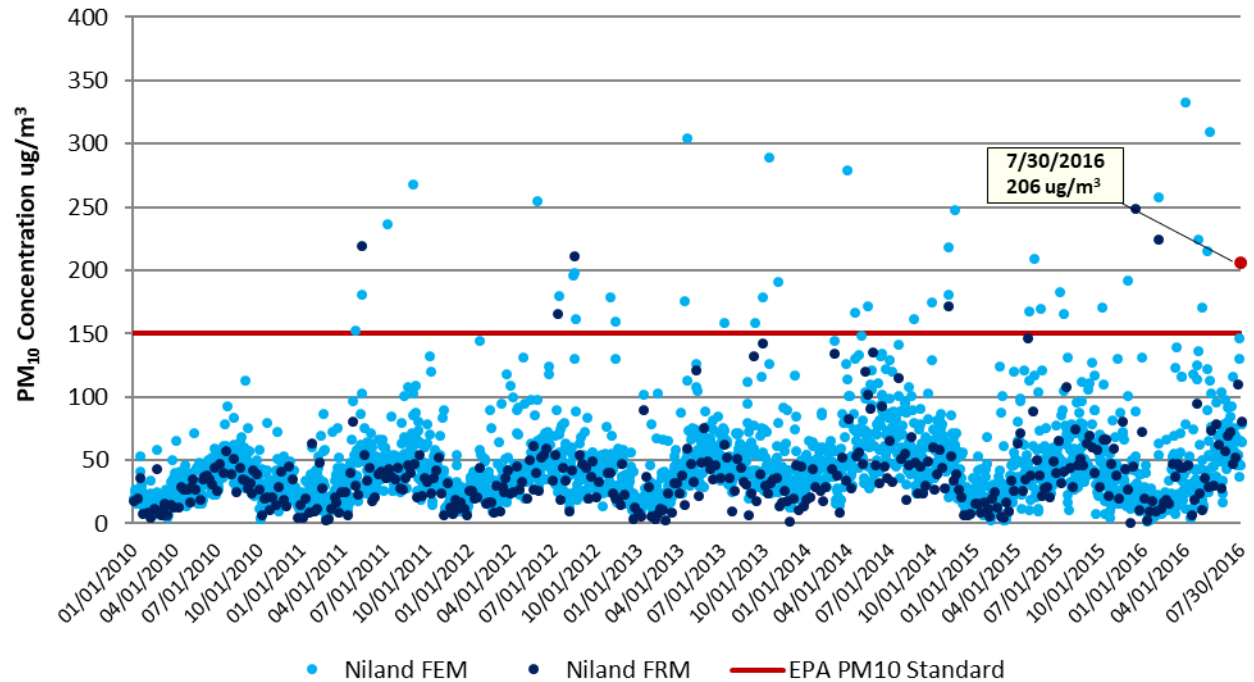


**Fig 3-2:** A comparison of PM<sub>10</sub> historical concentrations demonstrates that the measured concentration of 158  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Calexico monitor was outside the normal historical concentrations when compared to similar days and non-event days. Of the 566 sampling days, there were 9 exceedance days, which is less than a 2% occurrence rate

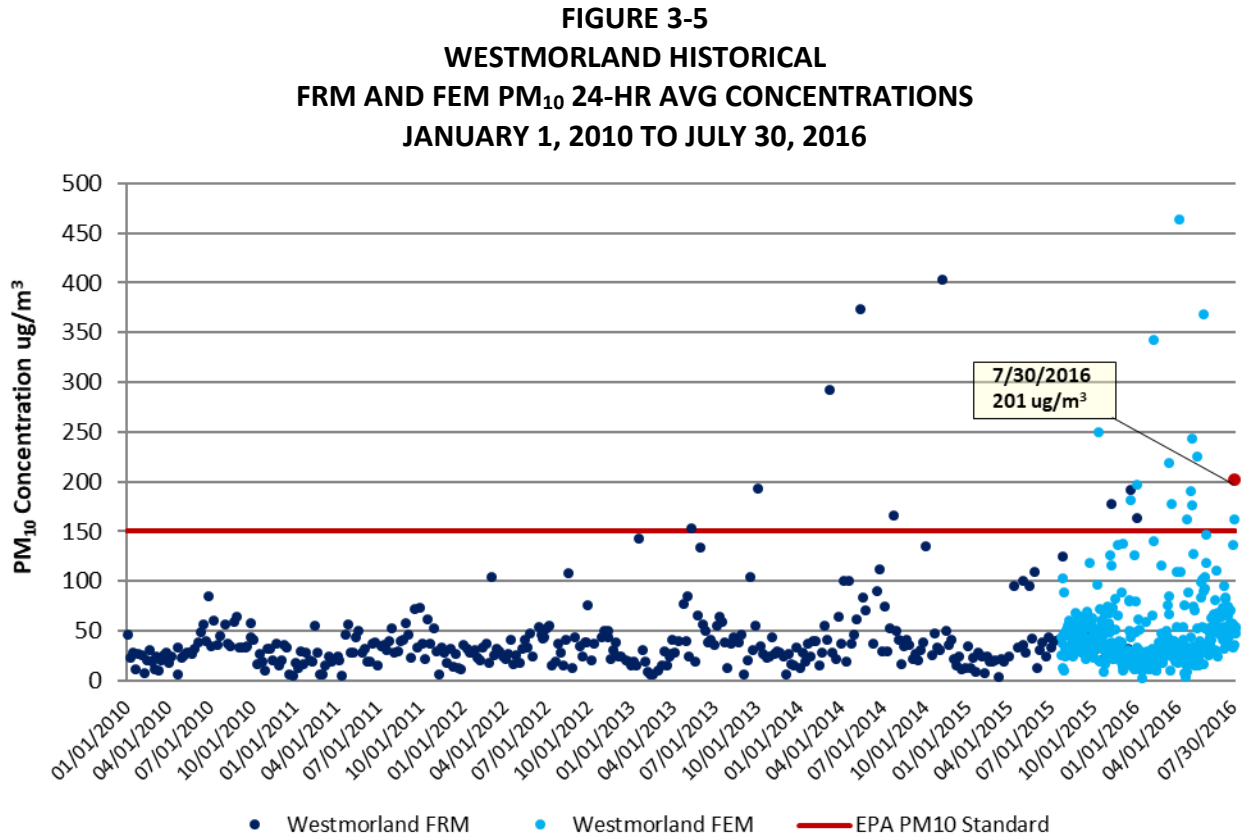


**Fig 3-3:** A comparison of PM<sub>10</sub> historical concentrations demonstrates that the measured concentration of 205  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the El Centro monitor was outside the normal historical concentrations when compared to similar days and non-event days. Of the 719 sampling days, there were 6 exceedance days, which is less than a 1% occurrence rate

**FIGURE 3-4**  
**NILAND HISTORICAL**  
**FRM AND FEM PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**JANUARY 1, 2010 TO JULY 30, 2016**



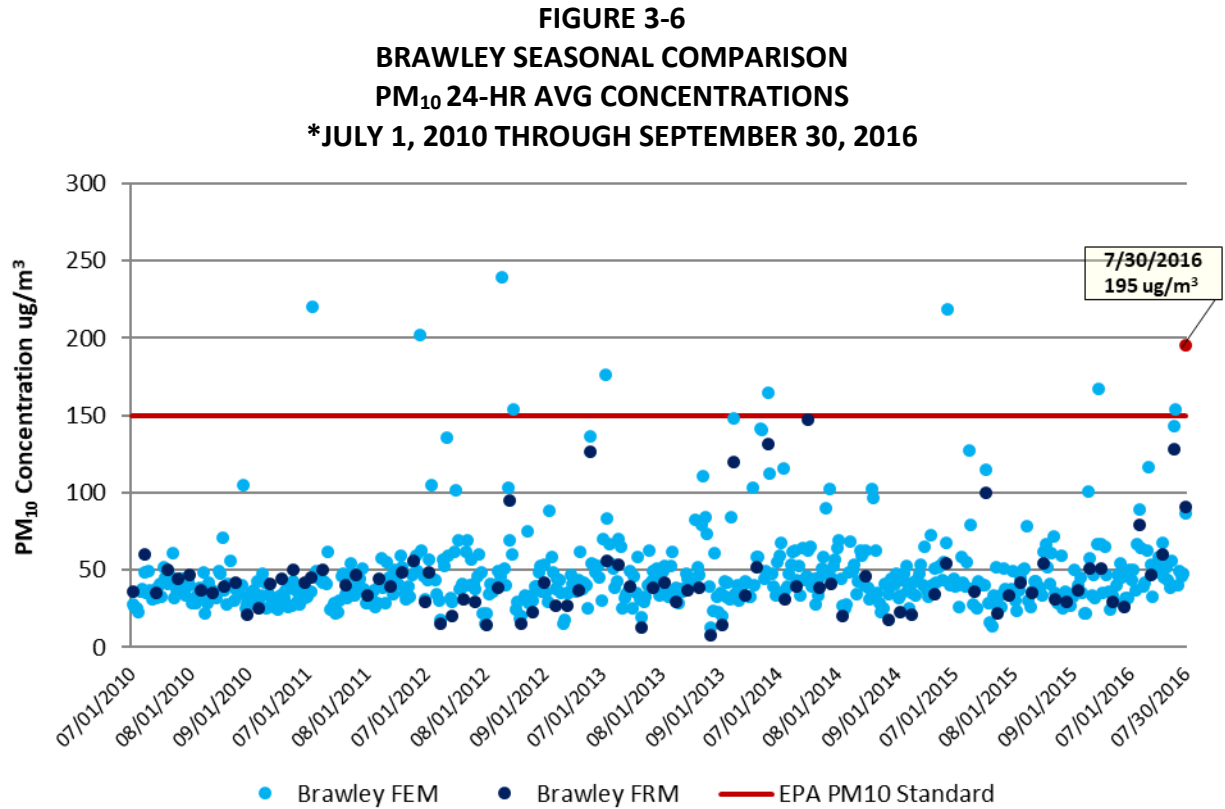
**Fig 3-4:** A comparison of PM<sub>10</sub> historical concentrations demonstrates that the measured concentration of 206  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Niland monitor was outside the normal historical concentrations when compared to similar days and non-event days. Of the 2,403 sampling days, there were 44 exceedance days, which is less than a 2% occurrence rate



**Fig 3-5:** A comparison of PM<sub>10</sub> historical concentrations demonstrates that the measured concentration of 201  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Westmorland monitor was outside the normal historical concentrations when compared to similar days and non-event days. Of the 719 sampling days, there were 22 exceedance days, which is less than a 3.1% occurrence rate

The time series, **Figures 3-1 through 3-5** for Brawley, Calexico, El Centro, Niland, and Westmorland included 2,403 sampling days (January 1, 2010 through July 30, 2016). During the January 1, 2010 through July 30, 2016 period the Brawley, Calexico, El Centro, Niland and Westmorland monitors measured 7,603 combined credible samples.

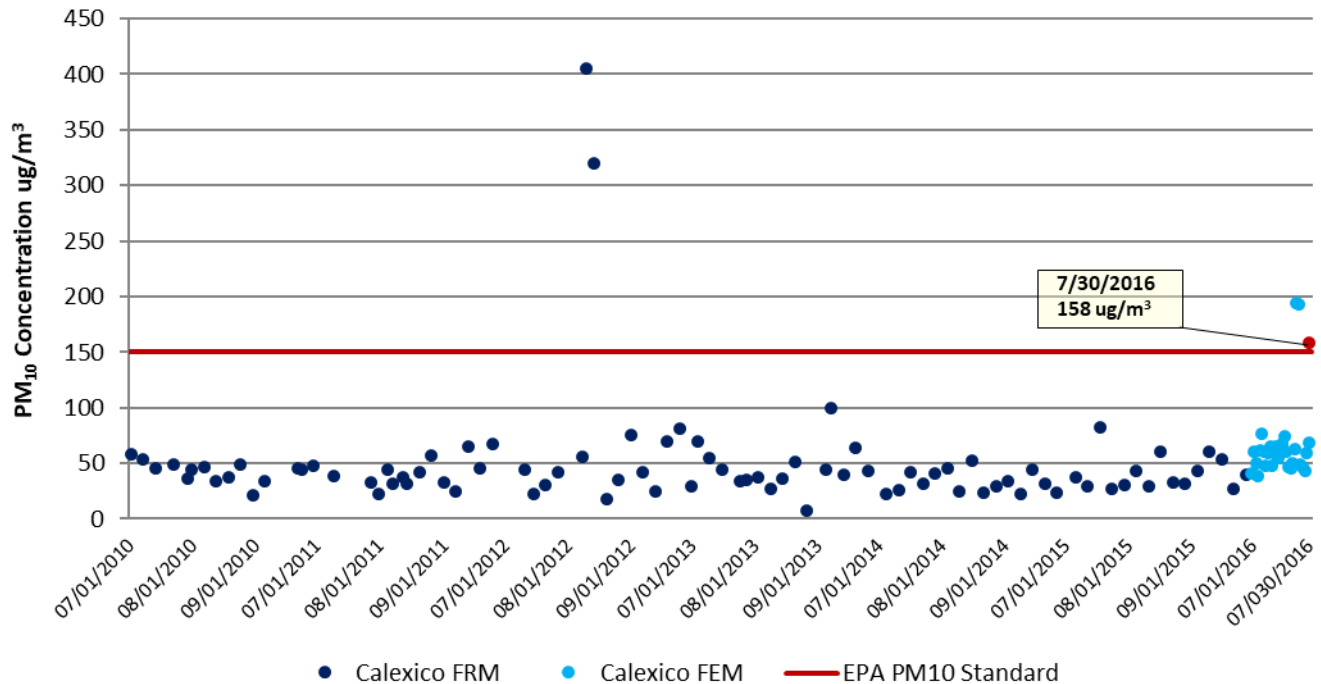
Overall, the time series illustrates that the Brawley, Calexico, El Centro, Niland and Westmorland monitors, measured 80 exceedance days out of 2,403 sampling days, which is less than a 4% occurrence rate. Of the 80 exceedance days, 18 exceedance days occurred during the third quarter (July – September). The remaining 62 exceedance days occurred during the first, second and fourth quarters. The July 30, 2016 concentrations are outside the normal historical measurements for the third quarter. No exceedances of the standard occurred during 2010. As mentioned above, FEM BAM data was not regulatory from 2010 to 2012.



\*July 1, 2010 through September 30, 2015 and July 1, 2016 through July 30, 2016

**Fig 3-6:** A comparison of PM<sub>10</sub> seasonal concentrations demonstrates that the measured concentration of 195  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Brawley monitor was outside the normal seasonal measurements. Of the 674 credible samples measured within 582 sampling days only 9 exceedance days occurred or a less than a 2% occurrence rate

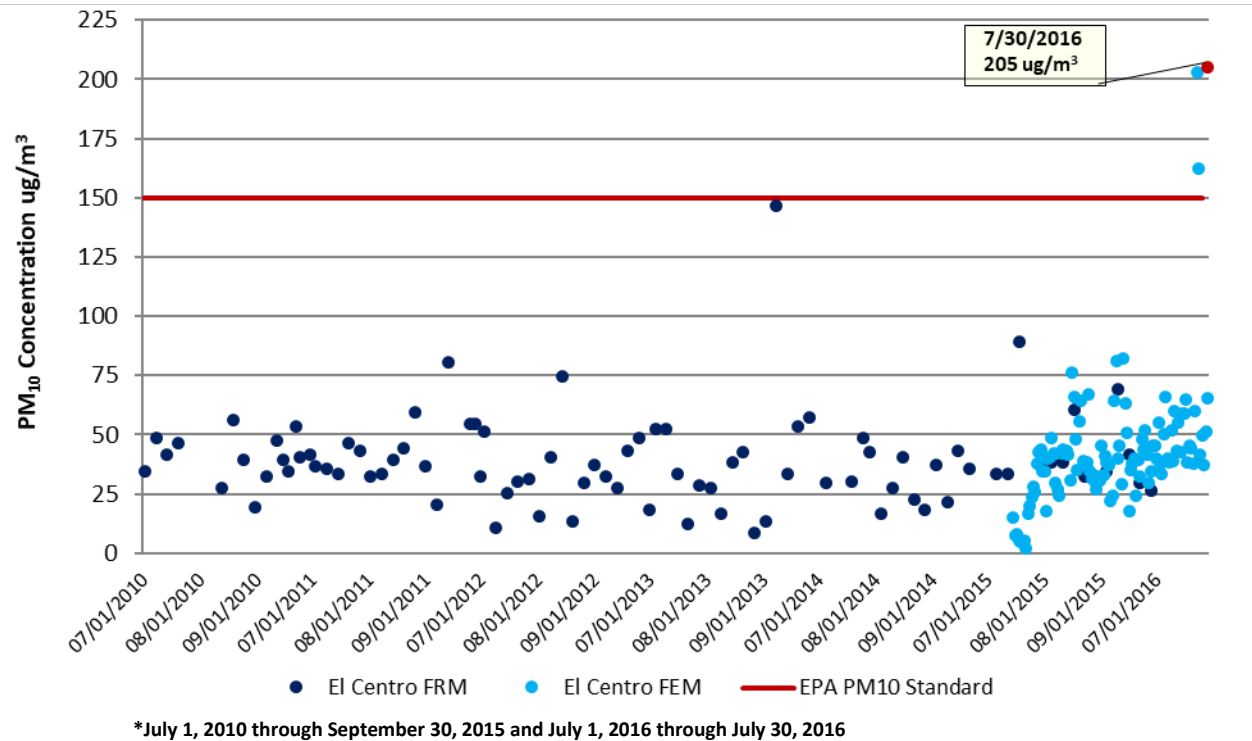
**FIGURE 3-7**  
**CALEXICO SEASONAL COMPARISON**  
**PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**\*JULY 1, 2010 THROUGH SEPTEMBER 30, 2016**



\*July 1, 2010 through September 30, 2015 and July 1, 2016 through July 30, 2016

**Fig 3-7:** A comparison of PM<sub>10</sub> seasonal concentrations demonstrates that the measured concentration 158  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Calexico monitor was outside the normal seasonal measurements. Of the 119 credible samples measured within 123 sampling days only 5 exceedance days occurred or a less than a 4.5% occurrence rate

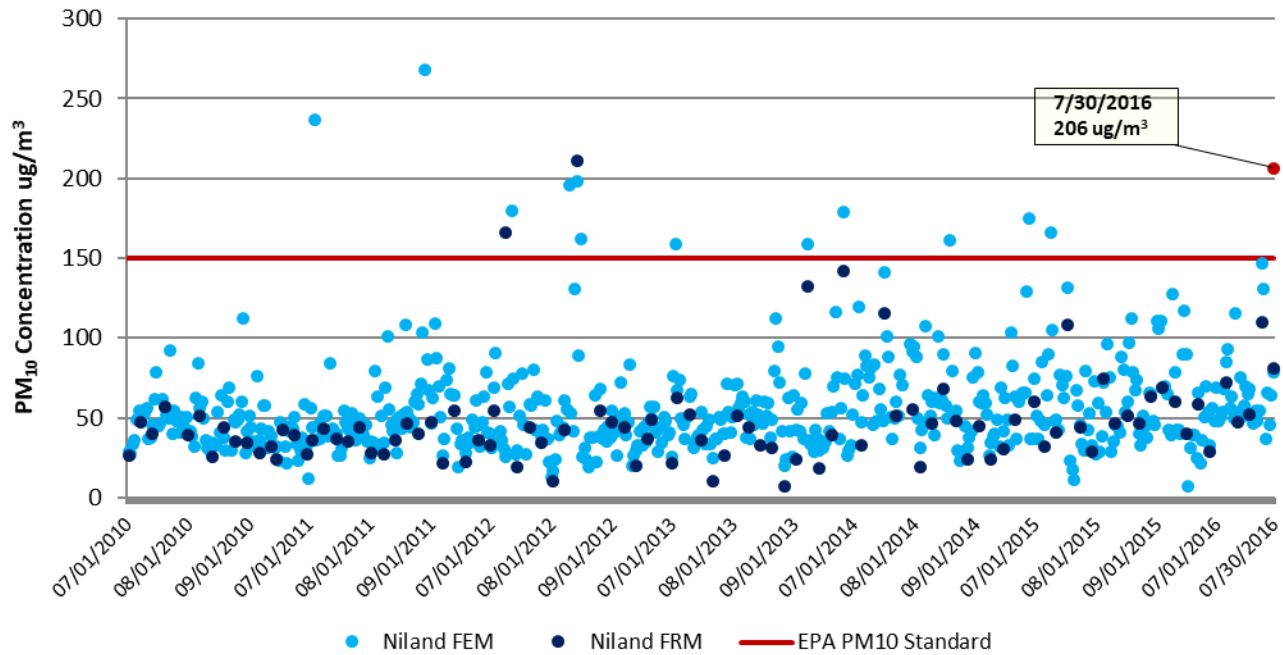
**FIGURE 3-8**  
**EL CENTRO SEASONAL COMPARISON**  
**PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**\*JULY 1, 2010 THROUGH SEPTEMBER 30, 2016**



\*July 1, 2010 through September 30, 2015 and July 1, 2016 through July 30, 2016

**Fig 3-8:** A comparison of PM<sub>10</sub> seasonal concentrations demonstrates that the measured concentration 205  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the El Centro monitor was outside the normal seasonal measurements. Of the 197 credible samples measured within 188 sampling days only 3 exceedance days occurred or a less than a 1.6% occurrence rate

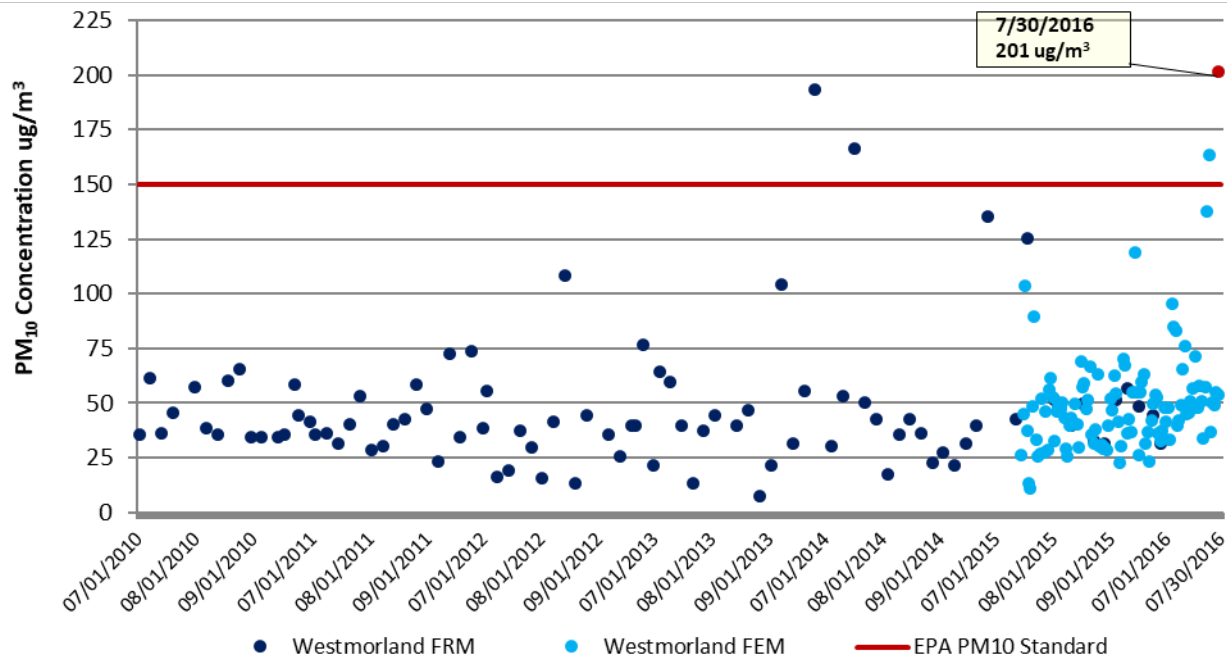
**FIGURE 3-9**  
**NILAND SEASONAL COMPARISON**  
**PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**\*JULY 1, 2010 THROUGH SEPTEMBER 30, 2016**



\*July 1, 2010 through September 30, 2015 and July 1, 2016 through July 30, 2016

**Fig 3-9:** A comparison of PM<sub>10</sub> seasonal concentrations demonstrates that the measured concentration 206 µg/m<sup>3</sup> as measured on July 30, 2016 by the Niland monitor was outside the normal seasonal measurements. Of the 674 credible samples measured within 582 sampling days only 14 exceedance days occurred or a less than a 2.5% occurrence rate

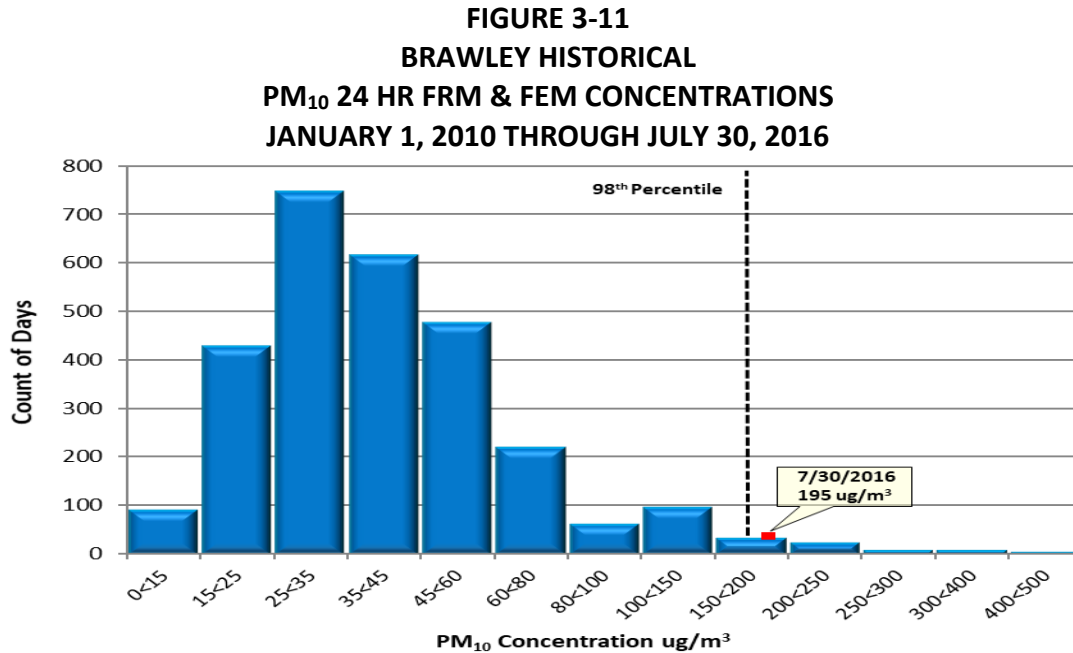
**FIGURE 3-10**  
**WESTMORLAND SEASONAL COMPARISON**  
**PM<sub>10</sub> 24-HR AVG CONCENTRATIONS**  
**\*JULY 1, 2010 THROUGH SEPTEMBER 30, 2016**



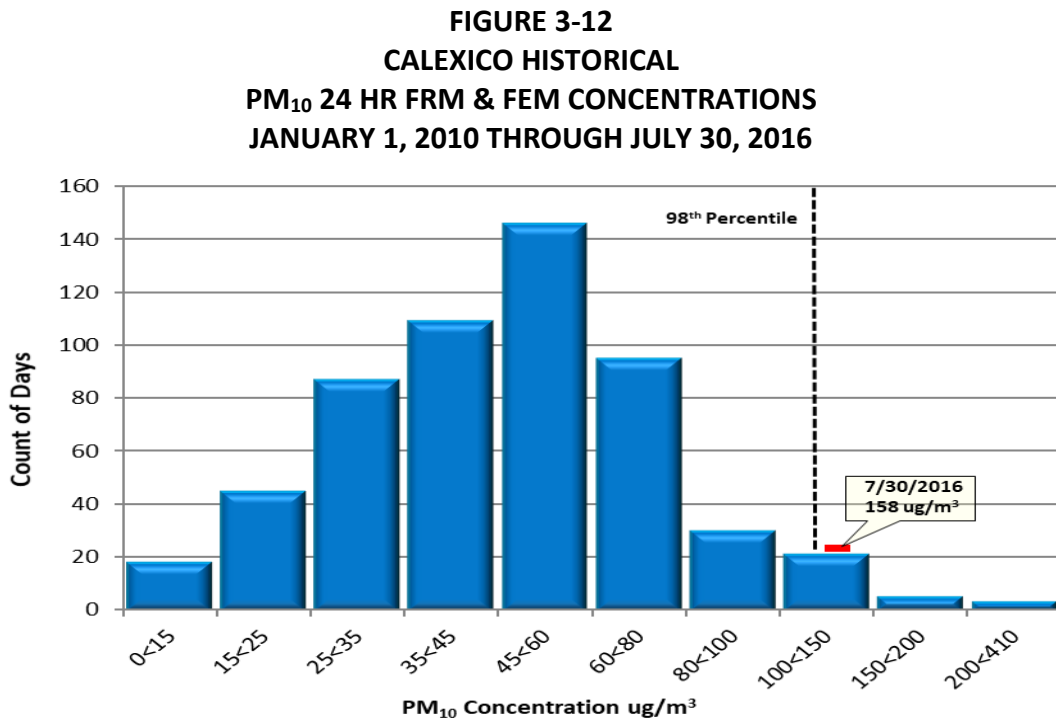
\*July 1, 2010 through September 30, 2015 and July 1, 2016 through July 30, 2016

**Fig 3-10:** A comparison of PM<sub>10</sub> seasonal concentrations demonstrates that the measured concentration 201  $\mu\text{g}/\text{m}^3$  as measured on July 30, 2016 by the Westmorland monitor was outside the normal seasonal measurements. Of the 198 credible samples measured within 188 sampling days only 4 exceedance days occurred or a less than a 2.5% occurrence rate

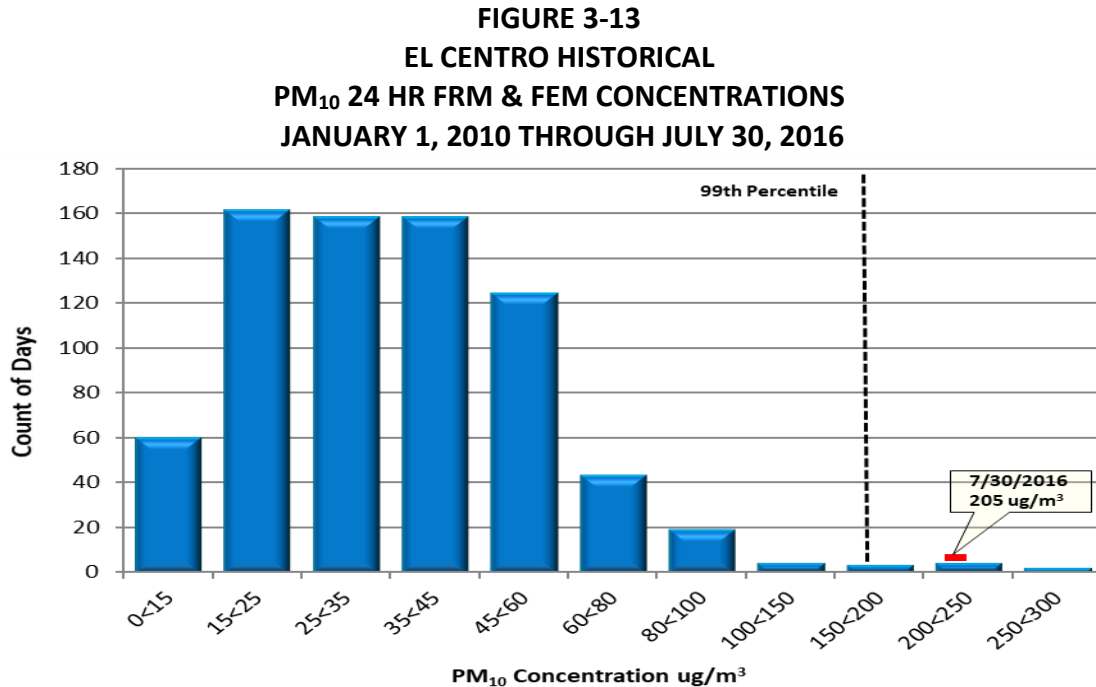
**Figures 3-6 through 3-10** display the seasonal fluctuations over 582 sampling days at the Brawley, Calexico, El Centro, Niland and Westmorland monitors for months July 1, 2010 through September 30, 2015 and July 1, 2016 through July 24, 2016. The combined seasonal sampling period for Brawley, Calexico, El Centro, Niland and the Westmorland monitors had 1,862 credible samples measured within 582 sampling days and 18 exceedances or a less than a 3.5% occurrence rate.



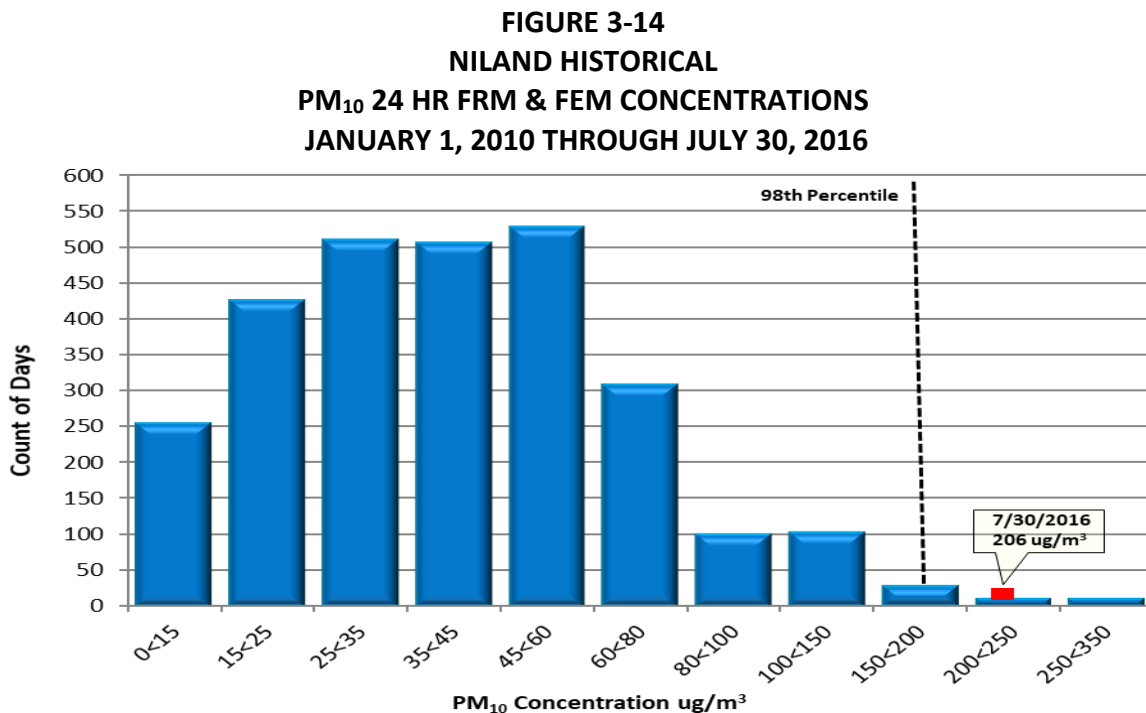
**Fig 3-11:** The 24-hr average PM<sub>10</sub> concentrations measured at the Brawley monitoring site demonstrates that the concentration of 195  $\mu\text{g}/\text{m}^3$  as measured during the July 30, 2016 event was in excess of the 98<sup>th</sup> percentile



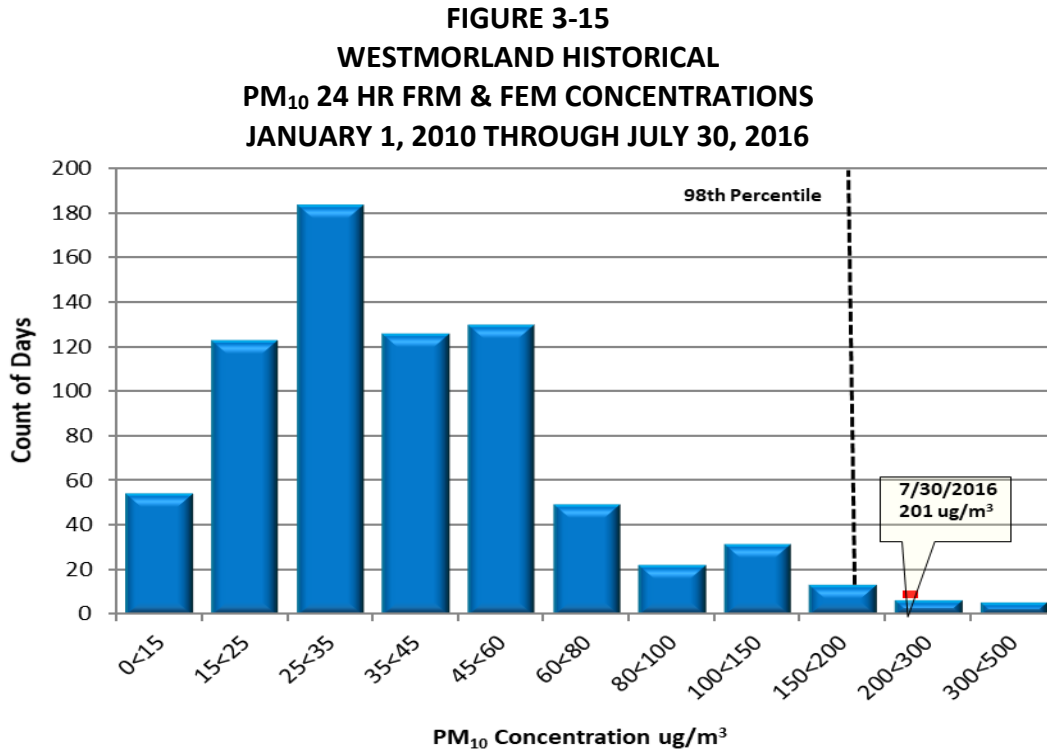
**Fig 3-12:** The 24-hr average PM<sub>10</sub> concentrations measured at the Calexico monitoring site demonstrates that the concentration of 158  $\mu\text{g}/\text{m}^3$  as measured during the July 30, 2016 event was in excess of the 98<sup>th</sup> percentile



**Fig 3-13:** The 24-hr average PM<sub>10</sub> concentrations measured at the El Centro monitoring site demonstrates that the concentration of 205  $\mu\text{g}/\text{m}^3$  as measured during the July 30, 2016 event was in excess of the 99<sup>th</sup> percentile



**Fig 3-14:** The 24-hr average PM<sub>10</sub> concentrations measured at the Niland monitoring site demonstrates that the concentration of 205  $\mu\text{g}/\text{m}^3$  as measured during the July 30, 2016 event was in excess of the 98<sup>th</sup> percentile



**Fig 3-15:** The 24-hr average PM<sub>10</sub> concentrations measured at the Westmorland monitoring site demonstrates that the concentration of 201 µg/m<sup>3</sup> as measured during the July 30, 2016 event was in excess of the 98<sup>th</sup> percentile

For the combined FRM and FEM data sets the annual historical and the seasonal historical PM<sub>10</sub> concentrations of 195 µg/m<sup>3</sup>, 158 µg/m<sup>3</sup>, 205 µg/m<sup>3</sup>, 206 µg/m<sup>3</sup>, and 201 µg/m<sup>3</sup> for Brawley, Calexico, El Centro, Niland, and Westmorland, respectively, are all above the 98<sup>th</sup> percentile ranking, while the concentration at El Centro was in excess of the 99<sup>th</sup> percentile. Looking at the annual time series concentrations, the seasonal time series concentrations, and the percentile rankings for the historical patterns, the July 30, 2016 measured exceedances are clearly outside the normal concentration levels when comparing to non-event days and event days.

### III.2 Summary

The information provided, above, by the time series plots, seasonal time series plots, and the percentile rankings illustrate that the PM<sub>10</sub> concentrations observed on July 30, 2016 occur infrequently. When comparing the measured PM<sub>10</sub> levels on July 30, 2016 and following USEPA EER guidance, this demonstration provides supporting evidence that the measured exceedance measured at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors were outside the normal historical and seasonal historical concentration levels.

The historical concentration analysis provided here supports the determination that the July 30, 2016 natural event affected the concentration levels at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors causing an exceedance. The concentration analysis further supports

that the natural event affected air quality in such a way that there exists a clear causal relationship between the measured exceedances on July 30, 2016 and the natural event, qualifying the natural event as an Exceptional Event.

## **IV Not Reasonably Controllable or Preventable**

According to the October 3, 2016 promulgated revision to the Exceptional Event (EE) rule under 40 CFR §50.14(b)(8) air agencies must address the “not reasonably controllable or preventable” (nRCP) criterion as two prongs. In order to properly address the nRCP criterion the ICAPCD must not only identify the natural and anthropogenic sources of emissions causing and contributing to the monitored exceedance but must identify the relevant State Implementation Plan (SIP) measures and/or other enforceable control measures in place for the identified sources. An effective analysis of the nRCP must include the implementation status of the control measures in order to properly consider the measures as enforceable. USEPA considers control measures to be enforceable if approved into the SIP within 5 years of an EE demonstration submittal. The identified control measures must address those specific sources that are identified as causing or contributing to a monitored exceedance.

The final EE rule revision explains that an event is considered not reasonably controllable if reasonable measures to control the impact of the event on air quality were applied at the time of the event. Similarly, an event is considered not reasonably preventable if reasonable measures to prevent the event were applied at the time of the event. However, for “high wind events” when PM<sub>10</sub> concentrations are due to dust raised by high winds from desert areas whose sources are controlled with Best Available Control Measures (BACM) then the event is a “natural event” where human activity plays little or no direct causal role and thus is considered not preventable.

This section begins by providing background information on all SIP and other enforceable control measures in force during the EE for July 30, 2016. In addition, this July 30, 2016 demonstration provides technical and non-technical evidence that a complex of thunderstorms pushed an outflow boundary across the natural open deserts in northern Mexico, Arizona and California affecting Imperial County. Strong and gusty outflow winds transported particulate matter affecting the Brawley, Calexico, El Centro, Niland, and Westmorland monitors on July 30, 2016. This section identifies all natural and anthropogenic sources and provides regulatory evidence of the enforceability of the control measures in place during the July 30, 2016 EE.

### **IV.1 Background**

Inhalable particulate matter (PM<sub>10</sub>) contributes to effects that are harmful to human health and the environment, including premature mortality, aggravation of respiratory and cardiovascular disease, decreased lung function, visibility impairment, and damage to vegetation and ecosystems. Upon enactment of the 1990 Clean Air Act (CAA) amendments, Imperial County was classified as moderate nonattainment for the PM<sub>10</sub> NAAQS under CAA sections 107(d)(4)(B) and 188(a). By November 15, 1991, such areas were required to develop and submit State Implementation Plan (SIP) revisions providing for, among other things, implementation of reasonably available control measures (RACM).

July 30, 2016 Exceptional Event, Imperial County

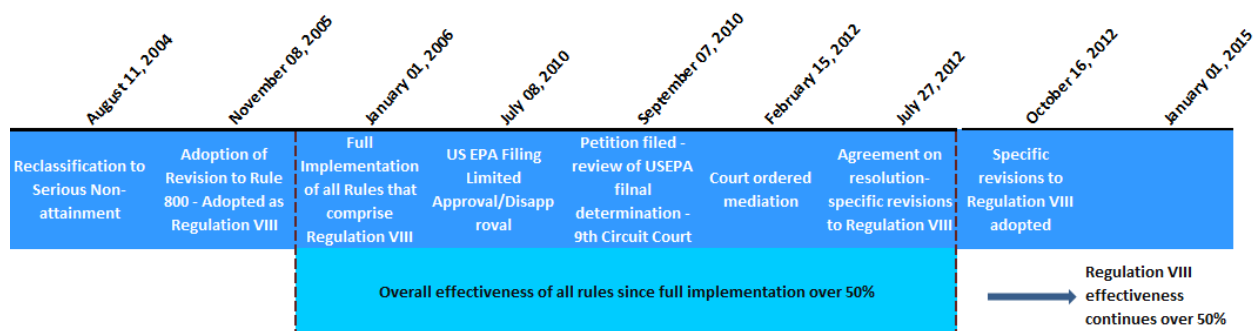
Partly to address the RACM requirement, ICAPCD adopted local Regulation VIII rules to control PM<sub>10</sub> from sources of fugitive dust on October 10, 1994, and revised them on November 25, 1996. USEPA did not act on these versions of the rules with respect to the federally enforceable SIP.

On August 11, 2004, USEPA reclassified Imperial County as a serious nonattainment area for PM<sub>10</sub>. As a result, CAA section 189(b)(1)(B) required all BACM to be implemented in the area within four years of the effective date of the reclassification, i.e., by September 10, 2008.

On November 8, 2005, partly to address the BACM requirement, ICAPCD revised the Regulation VIII rules to strengthen fugitive dust requirements. On July 8, 2010, USEPA finalized a limited approval of the 2005 version of Regulation VIII, finding that the seven Regulation VIII rules largely fulfilled the relevant CAA requirements. Simultaneously, USEPA also finalized a limited disapproval of several of the rules, identifying specific deficiencies that needed to be addressed to fully demonstrate compliance with CAA requirements regarding BACM and enforceability.

In September 2010, ICAPCD and the California Department of Parks and Recreation (DPR) filed petitions with the Ninth Circuit Federal Court of Appeals for review of USEPA's limited disapproval of the rules. After hearing oral argument on February 15, 2012, the Ninth Circuit directed the parties to consider mediation before rendering a decision on the litigation. On July 27, 2012, ICAPCD, DPR and USEPA reached agreement on a resolution to the dispute which included a set of specific revisions to Regulation VIII. These revisions are reflected in the version of Regulation VIII adopted by ICAPCD on October 16, 2012 and approved by USEPA April 22, 2013. Since 2006 ICAPCD had implemented regulatory measures to control emissions from fugitive dust sources and open burning in Imperial County.

**FIGURE 4-1  
REGULATION VIII GRAPHIC TIMELINE DEVELOPMENT**



**Fig 4-1: Regulation VIII Graphic Timeline**

#### IV.1.a Control Measures

Below is a brief summary of Regulation VIII, which is comprised of seven fugitive dust rules. **Appendix D** contains a complete set of the Regulation VIII rules.

ICAPCD's Regulation VIII consists of seven interrelated rules designed to limit emissions of PM<sub>10</sub> from anthropogenic fugitive dust sources in Imperial County.

Rule 800, General Requirements for Control of Fine Particulate Matter, provides definitions, a compliance schedule, exemptions and other requirements generally applicable to all seven rules. It requires the United States Bureau of Land Management (BLM), United States Border Patrol (BP) and DPR to submit dust control plans (DCP) to mitigate fugitive dust from areas and/or activities under their control. Appendices A and B within Rule 800 describe methods for determining compliance with opacity and surface stabilization requirements in Rules 801 through 806.

Rule 801, Construction and Earthmoving Activities, establishes a 20% opacity limit and control requirements for construction and earthmoving activities. Affected sources must submit a DCP and comply with other portions of Regulation VIII regarding bulk materials, carry-out and track-out, and paved and unpaved roads. The rule exempts single family homes and waives the 20% opacity limit in winds over 25 mph under certain conditions.

Rule 802, Bulk Materials, establishes a 20% opacity limit and other requirements to control dust from bulk material handling, storage, transport and hauling.

Rule 803, Carry-Out and Track-Out, establishes requirements to prevent and clean-up mud and dirt transported onto paved roads from unpaved roads and areas.

Rule 804, Open Areas, establishes a 20% opacity limit and requires land owners to prevent vehicular trespass and stabilize disturbed soil on open areas larger than 0.5 acres in urban areas, and larger than three acres in rural areas. Agricultural operations are exempted.

Rule 805, Paved and Unpaved Roads, establishes a 20% opacity limit and control requirements for unpaved haul and access roads, canal roads and traffic areas that meet certain size or traffic thresholds. It also prohibits construction of new unpaved roads in certain circumstances. Single-family residences and agricultural operations are exempted.

Rule 806, Conservation Management Practices, requires agricultural operation sites greater than 40 acres to implement at least one conservation management practice (CMP) for each of several activities that often generates dust at agricultural operations. In addition, agricultural operation sites must prepare a CMP plan describing how they comply with Rule 806, and must make the CMP plan available to the ICAPCD upon request.

#### **IV.1.b Additional Measures**

Imperial County Natural Events Action Plan (NEAP)

On August 2005, the ICAPCD adopted a NEAP for the Imperial County, as was required under the former USEPA Natural Events Policy, to address PM<sub>10</sub> events by:

- Protecting public health;
- Educating the public about high wind events;
- Mitigating health impacts on the community during future events; and
- Identifying and implementing BACM measures for anthropogenic sources of windblown dust.

#### Smoke Management Plan (SMP) Summary

There are 35 Air Pollution Control Districts or Air Quality Management Districts in California which are required to implement a district-wide smoke management program. The regulatory basis for California's Smoke Management Program, codified under Title 17 of the California Code of Regulations is the "Smoke Management Guidelines for Agricultural and Prescribed Burning" (Guidelines). California's 1987 Guidelines were revised to improve interagency coordination, avoid smoke episodes, and provide continued public safety while providing adequate opportunity for necessary open burning. The revisions to the 1987 Guidelines were approved March 14, 2001. All air districts, with the exception of the San Joaquin Valley Air Pollution Control District (SJAPCD) were required to update their existing rules and Smoke Management Plans to conform to the most recent update to the Guidelines.

Section 80150 of Title 17 specifies the special requirements for open burning in agricultural operations, the growing of crops and the raising of fowl or animals. This section specifically requires the ICAPCD to have rules and regulations that require permits that contain requirements that minimize smoke impacts from agricultural burning.

On a daily basis, the ICAPCD reviews surface meteorological reports from various airport agencies, the NWS, State fire agencies and CARB to help determine whether the day is a burn day. Using a four quadrant map of Imperial County allowed burns are allocated in such a manner as to assure minimal to no smoke impacts safeguarding the public health. Finally, all permit holders are required to notice and advise members of the public of a potential burn. This noticing requirement is known as the Good Neighbor Policy. On July 30, 2016 the ICAPCD declared a No Burn day (**Appendix A**). No complaints were filed for agricultural burning on July 30, 2016.

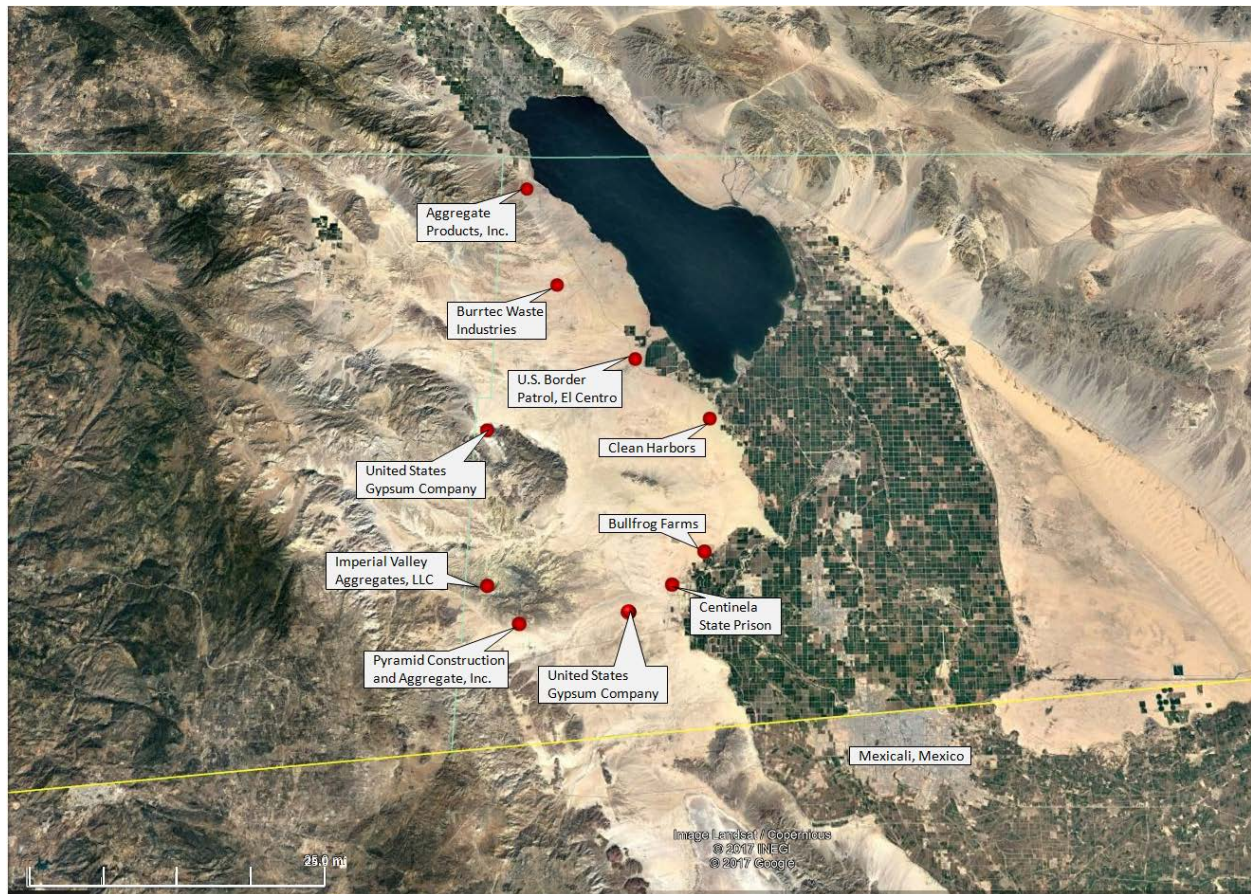
#### IV.1.c Review of Source Permitted Inspections and Public Complaints

A query of the ICAPCD permit database was compiled and reviewed for active permitted sources throughout Imperial County and specifically around Brawley, Calexico, El Centro, Niland, and Westmorland during the July 30, 2016 PM<sub>10</sub> exceedances. Both permitted and non-permitted sources are required to comply with Regulation VIII requirements that address fugitive dust emissions. The identified permitted sources are Aggregate Products, Inc., US Gypsum Quarry, Imperial Aggregates (Val-Rock, Inc., and Granite Construction), US Gypsum Plaster City, Clean Harbors (Laidlaw Environmental Services), Bullfrog Farms (Dairy), Burrtec Waste Industries, Border Patrol Inspection station, Centinela State Prison, various communications towers not listed and various agricultural operations. Non-permitted sources include the wind farm known

as Ocotillo Express, and a solar facility known as CSolar IV West. Finally, the desert regions are under the jurisdiction of the Bureau of Land Management and the California Department of Parks (Including Anza Borrego State Park and Ocotillo Wells).

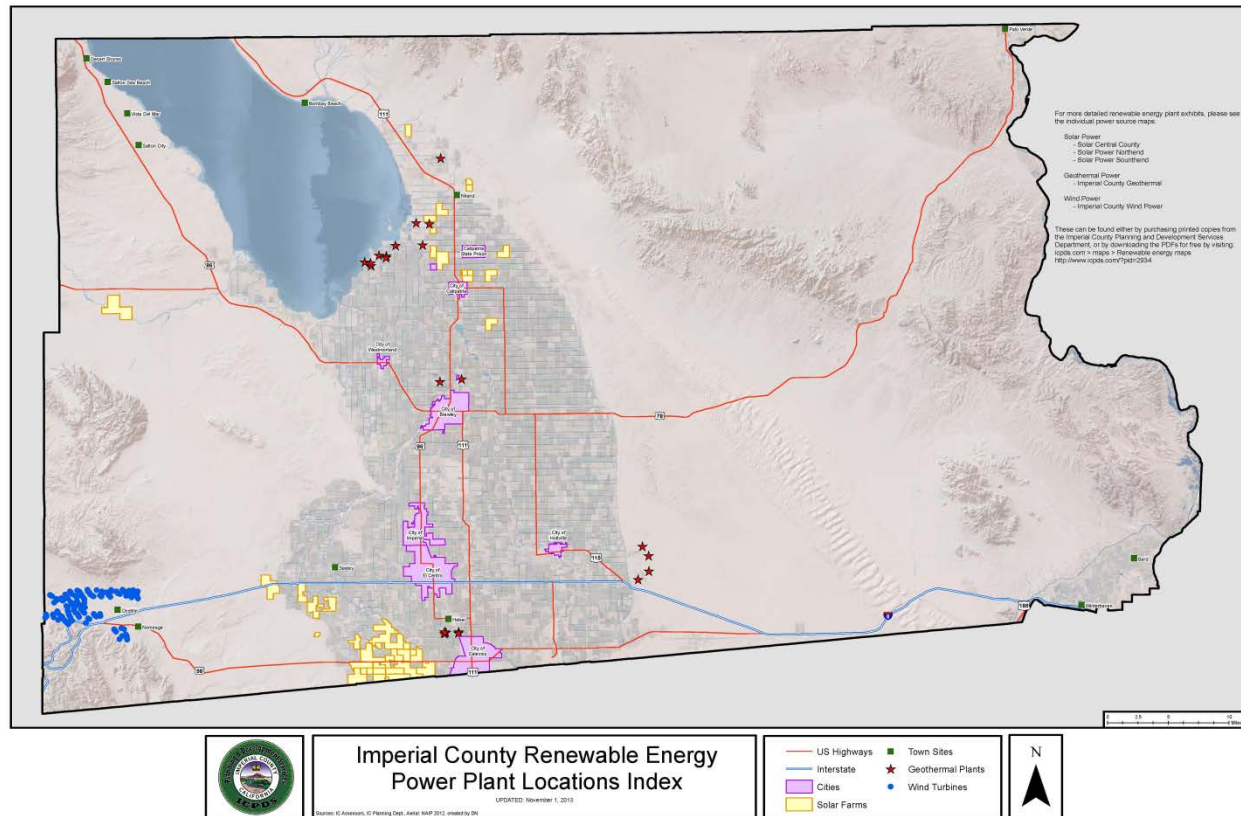
An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation indicate no evidence of unusual anthropogenic-based PM<sub>10</sub> emissions. There were no complaints filed on July 30, 2016, officially declared a no burn day, related to agricultural burning, waste burning or dust.

**FIGURE 4-2**  
**PERMITTED SOURCES**



**Fig 4-2:** The above map identifies those permitted sources located west, northwest and southwest of the Brawley, Calexico, El Centro, Niland and Westmorland monitors. The green line to the north denotes the political division between Imperial and Riverside counties. The yellow line below denotes the international border between the United States and Mexico. The green checker-boarded areas are a mixed use of agricultural and community parcels. In addition, the desert areas are managed either by the Bureau of Land Management or the California Department of Parks. Base map from Google Earth

**FIGURE 4-3**  
**NON-PERMITTED SOURCES**



**Fig 4-3:** The above map identifies those power sources located west, northwest and southwest of the Brawley, Calexico, El Centro, Niland and Westmorland monitors. Blue indicate the Wind Turbines, Yellow are the solar farms and stars are geothermal plants.

## IV.2 Forecasts and Warnings

As mentioned earlier, the ICAPCD published the National Weather Service (NWS) forecast for July 28, 2016 through August 1, 2016. The published notification, via the ICAPCD's webpage, forecast included the increase of monsoonal moisture for the weekend with an increased chance of showers and thunderstorms within the San Diego Mountains and deserts each afternoon and evening. The high-pressure was expected to weaken starting Friday, July 29, 2016 with better moisture profiles streaming north throughout the region with thunderstorm activity affecting the region in Arizona and California through the weekend. In addition to the ICAPCD posting, the Phoenix and San Diego NWS offices published weather stories advising of the potential for increased thunderstorm activity. The Phoenix NWS office published weather briefings for July 29, 2016, July 30, 2016 and July 31, 2016. Each briefing advised of the potential strong damaging winds, dense blowing dust, large hail and torrential rainfall in areas such as southwest and south-central Arizona, including Yuma, La Paz Maricopa, Pinal, and Gila counties with a somewhat lesser chance in southeast California. Nonetheless, the NWS advisories were well in advance of any

actual monsoonal activity. **Appendix A** contains copies of notices pertinent to the July 30, 2016 event.

### IV.3 Wind Observations

Wind data during the event were available from airports in eastern Riverside County, southeastern San Diego County, southwestern Yuma County (Arizona), northern Mexico, and Imperial County (**Table 2-2**). Data were also collected from automated meteorological instruments that were upstream from the Brawley, Calexico, El Centro, Niland, and Westmorland monitors during the wind event.

As explained earlier, the forecast for the weekend was expected as the intrusion of monsoonal moisture and consequential thunderstorm complex created strong outflow winds. As the inverted trough collapsed and moved northwest outflow winds created widespread blowing dust within the natural open desert areas. As early as July 29, 2016, winds increased as measured at the Yuma MCAS (KNYL) during the early hours through the evening hours with intermittent gusts. By 2200 PST July 29, 2016 KNYL measured winds remained elevated however gust became consistent between 25 mph and 41 mph. KNYL reported widespread dust and a dust storm during the final hour of the evening. This is consistent with the observations made by the San Diego NWS office indicating a potential “haboob” under the cover of darkness. Elevated winds became consistent at Imperial County Airport (KIPL) and the El Centro NAF (KNJK) July 29, 2016 by 1500 PST with elevated gusts by 2300 PST at 37 mph to 41 mph.

Elevated winds continued through Saturday, July 30, 2016 with the highest measured winds between 0000 PST and 0400 PST at KNYL, KIPL and KNJK. KNYL measured a single hour at 25 mph with measured wind gusts between 29 mph and 38 mph along with widespread dust during the early am hours. KIPL measured two hours at or above 25 mph with measured wind gusts between 22 mph and 36 mph, haze was reported at 0000 PST through 0600 PST. KNJK measured one hour at 25 mph with measured wind gusts between 16 mph and 37 mph, haze was reported at 0500 PST and 0600 PST.

Finally, the Mexicali, Mexico International Airport (MMML) reported winds of 31 mph during the first hour of July 30, 2016 with multiple observations of blowing dust at the airport. San Luis Colorado, Mexico, measured gusts of 49 mph during the first hour of July 30, 2016. Wind speeds of 25 mph are normally sufficient to overcome most PM<sub>10</sub> control measures. During the July 30, 2016 event wind speeds were at or above the 25 mph threshold, overcoming the BACM in place.

### IV.4 Summary

The weather and air quality forecasts and warnings outlined in this section demonstrate that strong and gusty outflow winds transported uncontrollable PM<sub>10</sub> emissions affecting the Brawley, Calexico, El Centro, Niland, and Westmorland monitors on July 30, 2016. The BACM list as part of the control measures in Imperial County for fugitive dust emissions were in place at the time of the event. These control measures are required for areas designated as “serious” non-

attainment for PM<sub>10</sub>, such as Imperial County. Thus, the BACM in place at the time of the event were beyond reasonable. In addition, surface wind measurements at or upstream of Brawley, Calexico, El Centro, Niland, and Westmorland monitoring stations during the event were high enough (at or above 25 mph, with wind gusts of 38 to 49 mph) that BACM PM<sub>10</sub> control measures would have been overwhelmed.

Finally, a high wind dust event can be considered as a natural event, even when portions of the wind-driven emissions are anthropogenic, as long as those emissions have a clear causal relationship to the event and were determined to be not reasonably controllable or preventable. This demonstration has shown that the event that occurred on July 30, 2016 was not reasonably controllable or preventable despite the strong and in force BACM within the affected areas in Imperial County. This demonstration has similarly established a clear causal relationship between the exceedances and the high wind event timeline and geographic location. The July 30, 2016 event can be considered an exceptional event under the requirements of the exceptional event rule.

## **V Clear Causal Relationship**

### **V.1 Discussion**

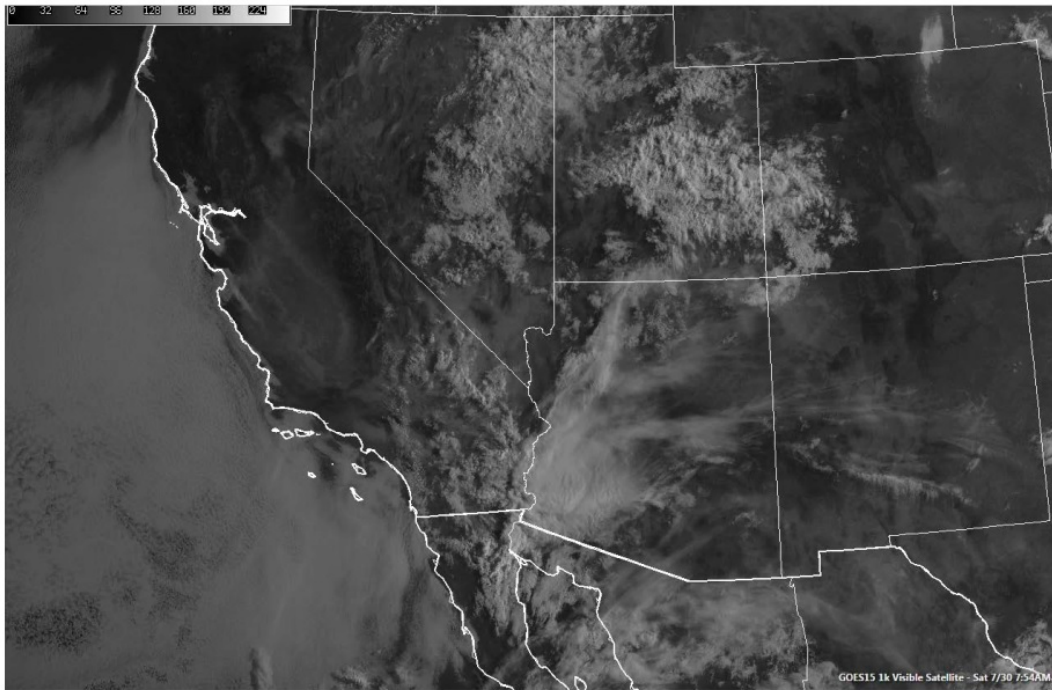
Meteorological observations for July 30, 2016 identified a humid airmass that moved into the Desert Southwest causing a drop in temperature, thunderstorm activity and associated strong outflow winds, blowing dust, lightning and localized flooding. As discussed earlier, the NWS office in San Diego discussed the intrusion of monsoonal moisture as early as Thursday July 28, 2016 as well as identifying thunderstorm activity in Nevada, Arizona and Baja Mexico. In contrast, the NWS office in Phoenix identified thunderstorm activity primarily within the Phoenix area, such as in Gila County days prior to Saturday, July 30, 2016. In any event, both NWS offices expected the large inverted trough that developed over Mexico to provide the meteorological conditions favorable for a very active, high impact weather situation.

As a result, the Phoenix NWS office issued 19 different types of notices including Urgent Weather Messages, Special Weather Statements, Bulletins, and Watch Notifications as well as Preliminary Storm reports. These messages all warned of dense and widespread blowing dust created by the outflow winds associated with the very active convection where thunderstorm outflows moved from Arizona to California. The earliest Urgent Weather Message issued at 0838 PST (0939 MST) July 29, 2016 by the Phoenix NWS office identified Maricopa County, Pinal County, the greater Phoenix area along with the southwest deserts in Arizona (**Figure 5-2**). Notices, watches and special storm reports followed through the evening hours of Saturday, July 30, 2016. By 1025 PST, Friday July 29, 2016 Imperial County and Riverside County were specifically named as impacted areas. All these notices contained cautionary notes regarding widespread blowing dust. Finally, the NWS office in San Diego identified a thunderstorm complex over southwest and south central Arizona that pushed an outflow boundary across the lower deserts Friday, July 29, 2016 during the evening hours (midnight). The description by the San Diego NWS office described the outflow boundary as pushing what would have been an impressive haboob across the lower deserts under the cover of darkness.

Entrained windblown dust from natural areas, particularly from the natural open desert areas south-to-southeast of Imperial County, along with anthropogenic sources controlled with BACM, is confirmed by the meteorological and air quality observations on July 30, 2016.

**Figures 5-1 and 5-2** provide information regarding the weather system and the areas affected by the outflow winds. Areas mentioned in Urgent Weather Messages, Special Weather Statements, Preliminary Local Storm Reports, and Bulletins included Maricopa County, Pinal County, La Paz County, Imperial County, Riverside County and Yuma County.

**FIGURE 5-1**  
**GOES VISIBLE SATELLITE JULY 30, 2016**



**Fig 5-1:** A GOES 15 1K visible satellite image, captured at 0654 PST, shows the clouds associated with the monsoonal system over the CA-AZ border July 30, 2016. A surge of a humid airmass provided the meteorological conditions conducive to the formation of a very active thunderstorm complex. The associated outflow boundaries resulted in strong and gusty winds that transported dust from the open natural deserts into California and Imperial County. Source: NWS

**FIGURE 5-2**  
**DENSE AND WIDESPREAD DUST WARNINGS ISSUED FOR THE REGION**



**Fig 5-2:** The NWS office in Phoenix issued 19 different warnings, watches, advisories for areas identified above. These notices advised of dense blowing dust resulting from strong winds from thunderstorm activity across the region. Base map: Google Earth

**Figure 5-3** shows the Aerosol Optical Depth<sup>15</sup> over Imperial County captured by the MODIS instrument onboard the Terra satellite on Saturday, July 30, 2016. **Figure 5-4** utilizes the Deep Blue Aerosol Angstrom Exponent<sup>16</sup> to differentiate the various sized of aerosols. Progressively larger particles are indicated by progressively darker shades of green. This is useful in showing heavier aerosols that indicate dust. Although the Terra satellite made its pass at ~1030 PST which

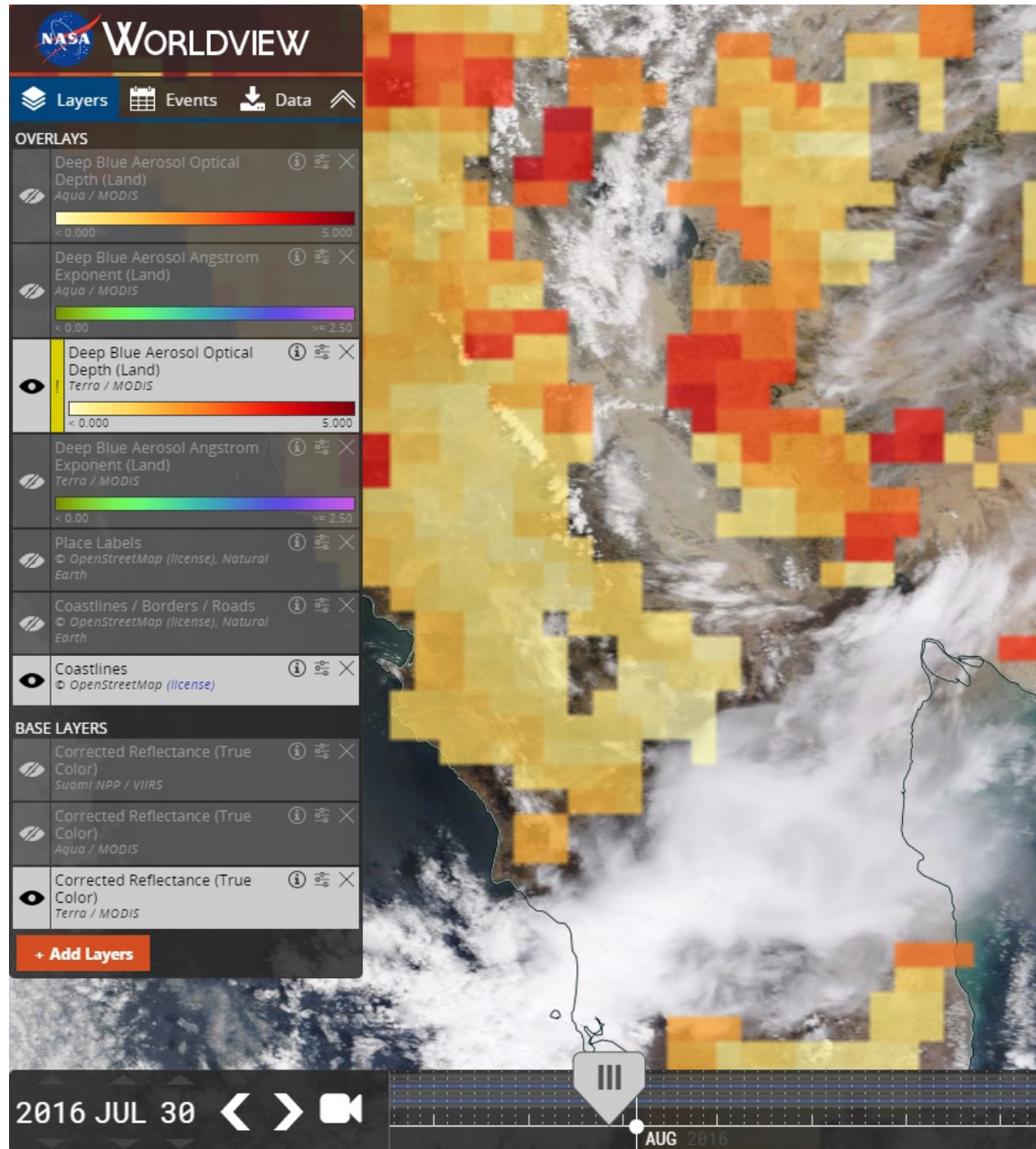
<sup>15</sup> Aerosol Optical Depth (AOD) (or Aerosol Optical Thickness) indicates the level at which particles in the air (aerosols) prevent light from traveling through the atmosphere. Aerosols scatter and absorb incoming sunlight, which reduces visibility. From an observer on the ground, an AOD of less than 0.1 is "clean" - characteristic of clear blue sky, bright sun and maximum visibility. As AOD increases to 0.5, 1.0, and greater than 3.0, aerosols become so dense that sun is obscured. Sources of aerosols include pollution from factories, smoke from fires, dust from dust storms, sea salt, and volcanic ash and smog. Aerosols compromise human health when inhaled by people, particularly those with asthma or other respiratory illnesses. Source: <https://worldview.earthdata.nasa.gov>

<sup>16</sup> The MODIS Deep Blue Aerosol Ångström Exponent layer can be used to provide additional information related to the aerosol particle size over land. This layer is created from the Deep Blue (DB) algorithm, originally developed for retrieving over desert/arid land (bright in the visible wavelengths). The Ångström exponent provides additional information on the particle size (larger the exponent, the smaller the particle size). Values < 1 suggest optical dominance of coarse particles (e.g. dust) and values > 1 suggest optical dominance of fine particles (e.g. smoke) <https://worldview.earthdata.nasa.gov>; The Ångström Exponent (denoted as AE or  $\alpha$ ) is a measure of how the AOD changes relative to the various wavelength of light (known as 'spectral dependence'.) This is related to the aerosol particle size. Roughly speaking, values less than 1 suggest an optical dominance of coarse particles (e.g. dust, ash, sea spray), while values greater than one 1 dominance of fine particles (e.g. smoke, industrial pollution); <https://deepblue.gsfc.nasa.gov/science>

was hours after the peak concentrations, it does support that a great deal of large-particle aerosols had been stirred up.

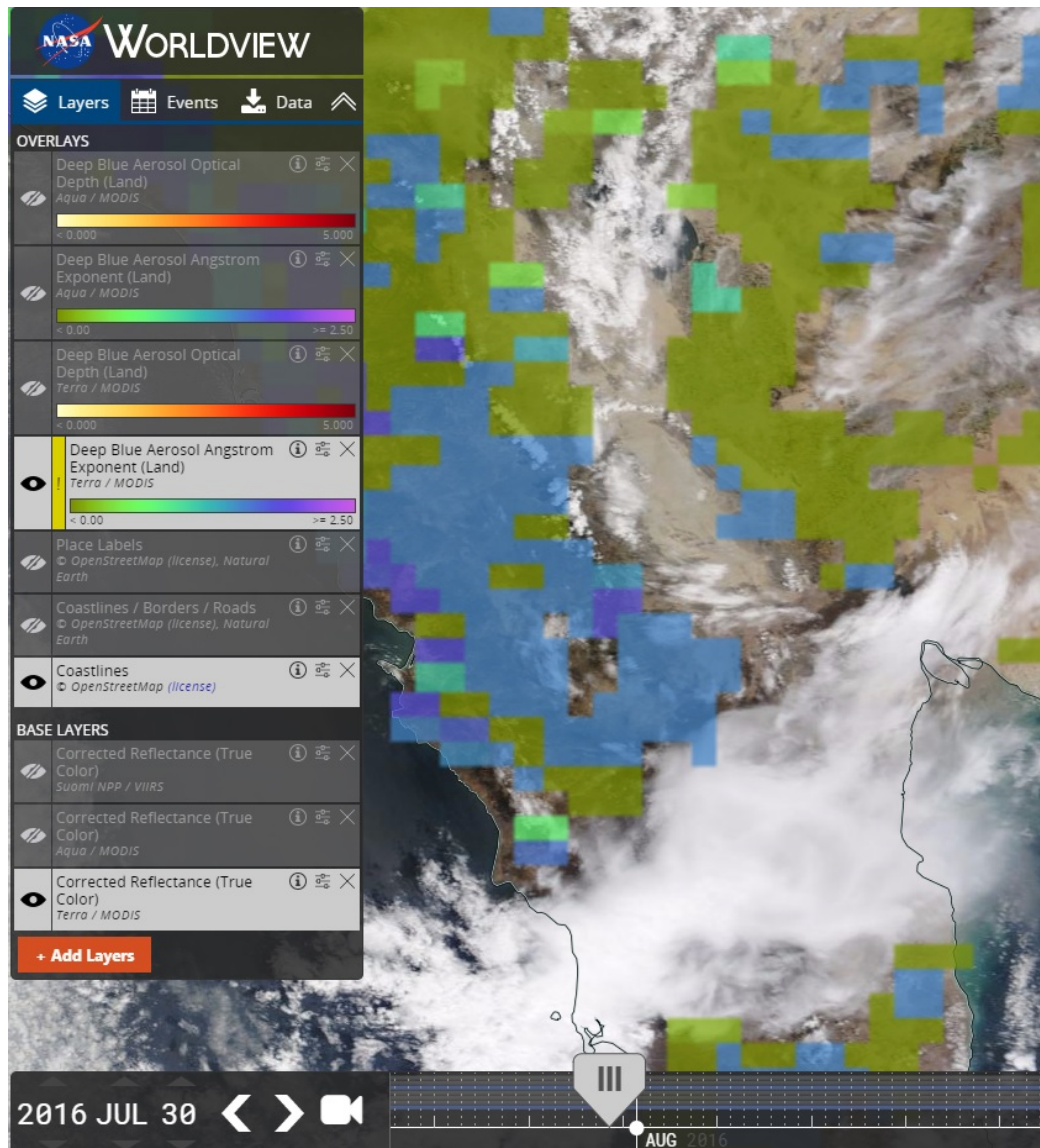
FIGURE 5-3

TERRA MODIS CAPTURES AEROSOLS OVER IMPERIAL COUNTY – JULY 30



**Fig 5-3:** The MODIS instrument onboard the Terra satellite captured a moderately thick layer of aerosols drifting over Imperial County at ~10:30 PST on July 30, 2016. Warmer colors indicate thicker AOD. Source: NASA Worldview; <https://worldview.earthdata.nasa.gov>

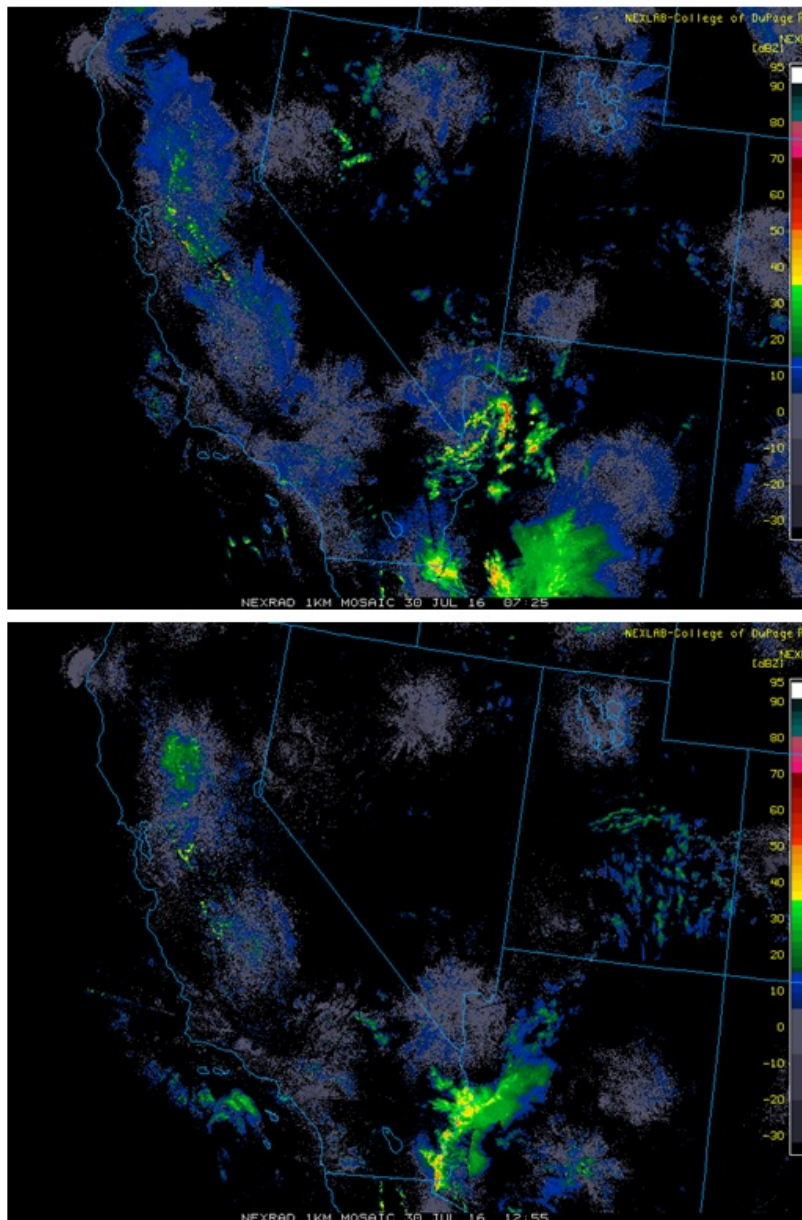
**FIGURE 5-4**  
**TERRA MODIS CAPTURES DUST-SIZED AEROSOLS OVER IMPERIAL COUNTY – JULY 30**



**Fig 5-4:** The MODIS instrument onboard the Terra satellite captured a thick layer of large particle aerosols drifting over Imperial County at ~10:30 PST on July 30, 2016. Green colors indicate thicker aerosols that are more likely dust. Source: NASA Worldview; <https://worldview.earthdata.nasa.gov>

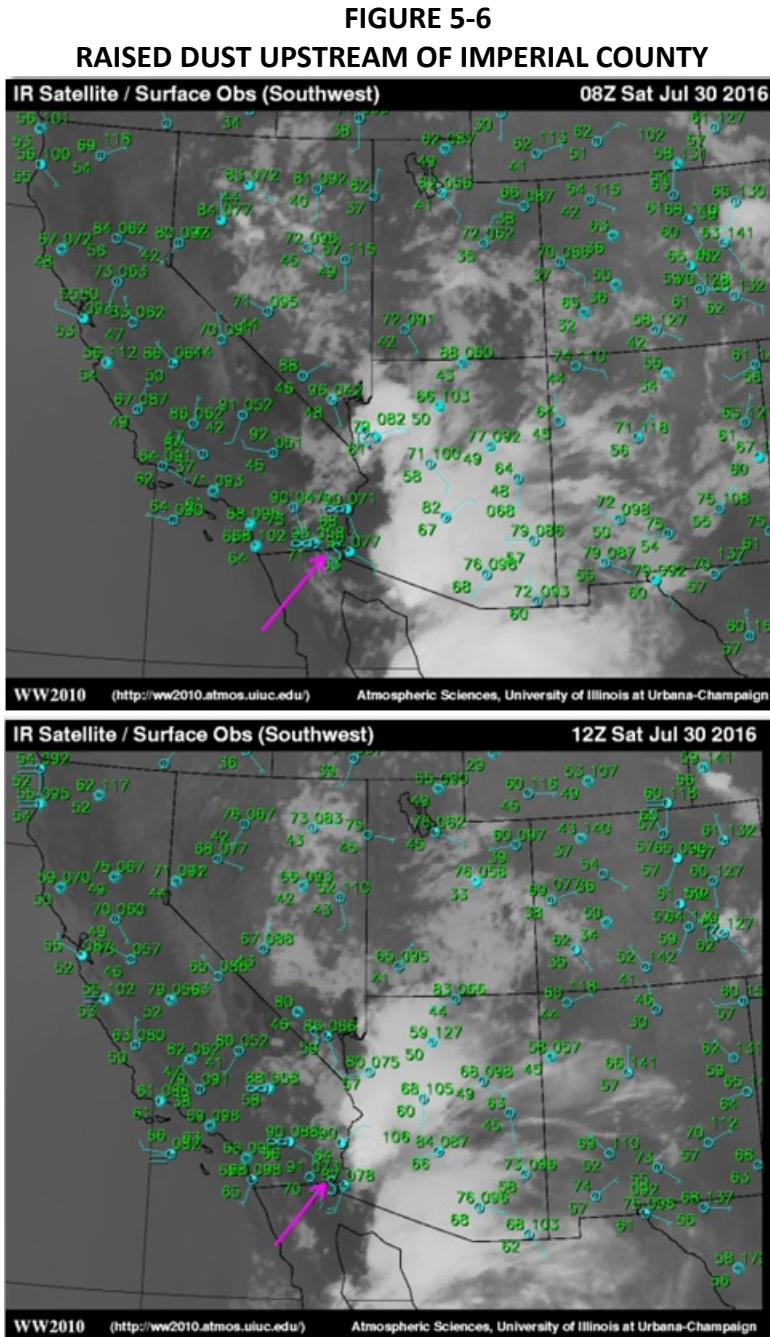
**Figure 5-5** is a pair of NEXRAD radar images that show intense portions of the monsoonal system positioned right along the CA-AZ border at 2325 LST July 29 (top) and the CA-MX-AZ border at 0455 LST July 30 (bottom). This was during the period that powerful winds were being reported in the region and high PM10 concentrations were being recorded.

**FIGURE 5-5**  
**INTENSE STORM CELLS CAPTURED BY NEXRAD RADAR**



**Fig 5-5:** NEXRAD radar mosaics captured intense storm cells in the vicinity of southeastern California. Outflow boundaries associated with the cells generated gusty winds during this period transporting windblown dust into Imperial County. Source: NEXLAB, College of DuPage; <http://weather.cod.edu>

**Figure 5-5** is a pair of Surface Observation maps for 0000 PST (top) and 0400 PST (bottom) on July 30, 2016. Both images have maroon icons indicating dust within the southeastern area of California. Windblown dust from outflow boundaries caused an exceedance at all air monitoring in Imperial County on July 30, 2016.



**Fig 5-6:** Two surface observation maps identified raised dust in the far southeast corner of California. Dust transported into the Imperial County from northern Mexico.

Source: University of Illinois Urbana-Champaign;

[http://ww2010.atmos.uiuc.edu/\(Gh\)/wx/surface.xml](http://ww2010.atmos.uiuc.edu/(Gh)/wx/surface.xml)

The EPA accepts a high wind threshold for sustained winds of 25 mph in California and 12 other states.<sup>17</sup> **Tables 5-1 through 5-5** provide a temporal relationship of wind speeds, wind direction,

<sup>17</sup> "Treatment of Data Influenced by Exceptional Events; Final Guidance", FR Vol. 81, No. 191, 68279, October 3, 2016

wind gusts (if available), and PM<sub>10</sub> concentrations at the exceeding stations on July 30, 2016. The tables show that peak hourly concentrations took place immediately following or during the period of high upstream wind speeds.

**TABLE 5-1**  
**BRAWLEY PM<sub>10</sub> CONCENTRATIONS AND WIND SPEEDS ON JULY 30, 2016**

EL CENTRO NAF (KNJK)				IMPERIAL CO. AIRPORT (KIPL)				Yuma, AZ MCAS (KNYL)					Mexicali, MX Intl. Airport (MMML)				Brawley	
HOUR	W/S	W/G	W/D	HOUR	W/S	W/G	W/D	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	Obs.	HOUR	PM <sub>10</sub> (µg/m <sup>3</sup> )
2256	9		130	2253	15		130	2257	26	41	90	DS	2240	15	110		2200	30
2356	30	41	110	2350	30	40	130	2357	22	29	110	BLDU	2340	31	90	BLDU	2300	951
28	28	37	120	40	25	36	120	157	18		160		13				0	
156	20	25	150	126	22	30	150	231	24		160		113				100	
256	20		170	253	28	36	160	344	25	38	200		213				200	567
356	11		190	311	24	34	160	412	24	38	210		313				300	509
456	6		180	453	10		10	557	25		240		413	9.2	140		400	432
556	16		80	553	16		90	657	6		340		552	23	70	BLDU	500	521
656	14		100	653	11		90	757	13		110		629	14	80	BLDU	600	711
756	7		170	753	3		180	857	11		200		746	10	140		700	342
856	7		190	853	10		200	957	15		200		844	9.2	160		800	180
956	5		VR	953	3		90	1057	9		200		942	16	130	BLDU	900	186
1056	13		100	1043	13	23	150	1157	11	21	200		1047	21	160	BLDU	1000	164
1156	15	28	120	1153	17	24	130	1257	16		180		1140	15	160		1100	136
1256	11	16	170	1253	15	24	130	1357	20		200		1243	13	150		1200	116
1356	10		120	1353	15	23	130	1457	17		200		1353	12	160		1300	83
1456	14	20	120	1453	13	22	130	1557	14		210		1452	15	150		1400	49
1556	14	21	140	1553	15		140	1657	14		200		1547	13	140		1500	51
1656	10		130	1653	15		130	1757	13		200		1640	16	150		1600	39
1756	14		140	1753	16		140	1857	9		200		1751	14	150		1700	30
1856	13		140	1853	11		130	1957	7		190		1842	13	140		1800	61
1956	11		130	1953	11		130	2057	10		200		1952	10	130		1900	60
2056	10		140	2053	13		130	2157	8		200		2040	17	130		2000	30
2156	11		130	2153	13		140	2257	11		170		2141	12	130		2100	20
2256	10		140	2253	13		140	2357	14		170		2246	9.2	110		2200	13
2356	13		140	2353	11		150	57	10		170		2340	13	130		2300	9

\*Blue hours indicate July 29, 2016. Wind data for KNYL, KIPL, and KNJK from the NCEI's QCLCD system measured in Local Standard Time. KNYL time adjust to meet PST. Brawley PM<sub>10</sub> data from AQS. Brawley station does not measure wind data. Mexicali Airport wind data from the University of Utah's MesoWest. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DS=Dust Storm

**TABLE 5-2**  
**CALEXICO PM<sub>10</sub> CONCENTRATIONS AND WIND SPEEDS ON JULY 30, 2016**

San Luis Colorado, MX (SLRS6)				Yuma, AZ MCAS (KNYL)					Mexicali, MX Intl. Airport (MMML)				Calexico			Calexico	
HOUR	W/S	W/G	W/D	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM <sub>10</sub> (µg/m <sup>3</sup> )
2300	24	49	117	2257	26	41	90	DS	2240	15	110		2200	6.4	125	2200	51
0	20	31	130	2357	22	29	110	BLDU	2340	31	90	BLDU	2300	15	110	2300	357
110	22	32	151	157	18		160		13				0:00	13	118	0	626
220	24	37	190	231	24		160		113				1:00	11	146	100	255
350	32	45	200	344	25	38	200		213				2:00	12	160	200	539
420	25	36	206	412	24	38	210		313				3:00	13	147	300	481
500	12	21	199	557	25		240		413	9.2	140		4:00	2.8	135	400	113
600	11	20	106	657	6		340		552	23	70	BLDU	5:00	3.7	87	500	168
700	6	8	42	757	13		110		629	14	80	BLDU	6:00	8.2	103	600	230
800	5	9	169	857	11		200		746	10	140		7:00	7.5	146	700	157
900	6	10	232	957	15		200		844	9.2	160		8:00	4.3	156	800	111
1000	13	19	206	1057	9		200		942	16	130	BLDU	9:00	5.5	145	900	137
1100	17	27	200	1157	11	21	200		1047	21	160	BLDU	10:00	11	117	1000	235
1200	16	25	209	1257	16		180		1140	15	160		11:00	11	124	1100	173
1300	15	23	190	1357	20		200		1243	13	150		12:00	11	126	1200	75
1400	18	26	199	1457	17		200		1353	12	160		13:00	10	121	1300	52
1500	14	21	178	1557	14		210		1452	15	150		14:00	10	132	1400	52
1600	16	23	199	1657	14		200		1547	13	140		15:00	9.2	125	1500	43
1700	15	21	203	1757	13		200		1640	16	150		16:00	9.3	129	1600	43
1800	15	21	203	1857	9		200		1751	14	150		17:00	9	127	1700	58
1900	13	18	196	1957	7		190		1842	13	140		18:00	7.9	127	1800	48
2000	10	16	188	2057	10		200		1952	10	130		19:00	8.3	133	1900	61
2100	10	17	178	2157	8		200		2040	17	130		20:00	7.6	132	2000	53
2200	10	15	179	2257	11		170		2141	12	130		21:00	7	131	2100	35
2300	12	18	169	2357	14		170		2246	9.2	110		22:00	7.7	131	2200	23
0	10	15	167	57	10		170		2340	13	130		23:00	8.3	132	2300	31

\*Blue hours indicate July 29, 2016. Wind data for KNYL, from the NCEI's QCLCD system. KNYL time adjust to meet PST Calexico PM<sub>10</sub> data from AQS. Calexico does not measure wind gusts. Mexicali Airport wind data and San Luis Colorado from the University of Utah's MesoWest. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DS=Dust Storm

**TABLE 5-3**  
**EL CENTRO PM<sub>10</sub> CONCENTRATIONS AND WIND SPEEDS ON JULY 30, 2016**

San Luis Colorado, MX (SLRS6)				Yuma, AZ MCAS (KNYL)					Mexicali, MX Intl. Airport (MMML)				El Centro			El Centro	
HOUR	W/S	W/G	W/D	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM <sub>10</sub> (µg/m <sup>3</sup> )
2300	24	49	117	2257	26	41	90	DS	2240	15	110		2200	7	125	2200	27
0	20	31	130	2357	22	29	110	BLDU	2340	31	90	BLDU	2300	13	101	2300	456
110	22	32	151	157	18		160		13				000	12	120	0	995
220	24	37	190	231	24		160		113				100	11	143	100	822
350	32	45	200	344	25	38	200		213				200	14	153	200	506
420	25	36	206	412	24	38	210		313				300	12	156	300	252
500	12	21	199	557	25		240		413	9.2	140		400	1.5	47	400	219
600	11	20	106	657	6		340		552	23	70	BLDU	500	12	49	500	256
700	6	8	42	757	13		110		629	14	80	BLDU	600	10	80	600	314
800	5	9	169	857	11		200		746	10	140		700	5.9	155	700	266
900	6	10	232	957	15		200		844	9.2	160		800	3.5	194	800	173
1000	13	19	206	1057	9		200		942	16	130	BLDU	900	2.3	235	900	158
1100	17	27	200	1157	11	21	200		1047	21	160	BLDU	1000	7.2	118	1000	166
1200	16	25	209	1257	16		180		1140	15	160		1100	9.6	119	1100	272
1300	15	23	190	1357	20		200		1243	13	150		1200	9.9	122	1200	123
1400	18	26	199	1457	17		200		1353	12	160		1300	8.8	127	1300	67
1500	14	21	178	1557	14		210		1452	15	150		1400	8	128	1400	48
1600	16	23	199	1657	14		200		1547	13	140		1500	8.6	130	1500	45
1700	15	21	203	1757	13		200		1640	16	150		1600	8	129	1600	35
1800	15	21	203	1857	9		200		1751	14	150		1700	8.5	132	1700	35
1900	13	18	196	1957	7		190		1842	13	140		1800	7.9	130	1800	33
2000	10	16	188	2057	10		200		1952	10	130		1900	6.8	136	1900	40
2100	10	17	178	2157	8		200		2040	17	130		2000	6.8	127	2000	38
2200	10	15	179	2257	11		170		2141	12	130		2100	6.5	142	2100	25
2300	12	18	169	2357	14		170		2246	9.2	110		2200	6.1	137	2200	16
0	10	15	167	57	10		170		2340	13	130		2300	6.5	141	2300	24

\*Blue hours indicate July 29, 2016. Wind data for KNYL, from the NCEI's QCLCD system. El Centro PM<sub>10</sub> data from AQS. El Centro does not report wind gusts. Mexicali Airport wind data and San Luis Colorado from the University of Utah's MesoWest. San Luis Rio Colorado and KNYL both adjusted to PST. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DS=Dust Storm

**TABLE 5-4**  
**NILAND PM<sub>10</sub> CONCENTRATIONS AND WIND SPEEDS ON JULY 30, 2016**

San Luis Colorado, MX (SLRS6)				Yuma, AZ MCAS (KNYL)					Mexicali, MX Intl. Airport (MMML)				Niland			Niland	
HOUR	W/S	W/G	W/D	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM <sub>10</sub> (µg/m <sup>3</sup> )
2300	24	49	117	2257	26	41	90	DS	2240	15	110		2200	8.2	123	2200	17
0	20	31	130	2357	22	29	110	BLDU	2340	31	90	BLDU	2300	18	121	2300	638
110	22	32	151	157	18		160		13				000	21	114	0	995
220	24	37	190	231	24		160		113				100	10	126	100	
350	32	45	200	344	25	38	200		213				200	5.9	130	200	
420	25	36	206	412	24	38	210		313				300	5	95	300	571
500	12	21	199	557	25		240		413	9.2	140		400	9.1	76	400	485
600	11	20	106	657	6		340		552	23	70	BLDU	500	17	99	500	741
700	6	8	42	757	13		110		629	14	80	BLDU	600	12	86	600	367
800	5	9	169	857	11		200		746	10	140		700	8.6	133	700	254
900	6	10	232	957	15		200		844	9.2	160		800	6.5	173	800	125
1000	13	19	206	1057	9		200		942	16	130	BLDU	900	3.1	159	900	179
1100	17	27	200	1157	11	21	200		1047	21	160	BLDU	1000	8.9	116	1000	144
1200	16	25	209	1257	16		180		1140	15	160		1100	12	128	1100	143
1300	15	23	190	1357	20		200		1243	13	150		1200	12	140	1200	152
1400	18	26	199	1457	17		200		1353	12	160		1300	11	137	1300	86
1500	14	21	178	1557	14		210		1452	15	150		1400	11	147	1400	48
1600	16	23	199	1657	14		200		1547	13	140		1500	12	145	1500	56
1700	15	21	203	1757	13		200		1640	16	150		1600	10	138	1600	36
1800	15	21	203	1857	9		200		1751	14	150		1700	9.1	132	1700	30
1900	13	18	196	1957	7		190		1842	13	140		1800	8.1	142	1800	25
2000	10	16	188	2057	10		200		1952	10	130		1900	7.7	138	1900	25
2100	10	17	178	2157	8		200		2040	17	130		2000	11	136	2000	28
2200	10	15	179	2257	11		170		2141	12	130		2100	11	129	2100	17
2300	12	18	169	2357	14		170		2246	9.2	110		2200	8.7	122	2200	16
0	10	15	167	57	10		170		2340	13	130		2300	9.8	116	2300	9

\*Blue hours indicate July 29, 2016. Wind data for KNYL, from the NCEI's QCLCD system. Niland PM<sub>10</sub> data from AQS. Niland does not measure wind gusts. Mexicali Airport wind data and San Luis Colorado from the University of Utah's MesoWest. San Luis Rio Colorado and KNYL both adjusted to PST. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DS=Dust Storm

**TABLE 5-5**  
**WESTMORLAND PM<sub>10</sub> CONCENTRATIONS AND WIND SPEEDS ON JULY 30, 2016**

San Luis Colorado, MX (SLRS6)				Yuma, AZ MCAS (KNYL)					Mexicali, MX Intl. Airport (MMML)				Westmorland			Westmorland	
HOUR	W/S	W/G	W/D	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM <sub>10</sub> (µg/m <sup>3</sup> )
2300	24	49	117	2257	26	41	90	DS	2240	15	110		2200	11	124	2200	29
0	20	31	130	2357	22	29	110	BLDU	2340	31	90	BLDU	2300	19	118	2300	
110	22	32	151	157	18		160		13				000	17	124	0	
220	24	37	190	231	24		160		113				100	12	144	100	
350	32	45	200	344	25	38	200		213				200	8.4	158	200	453
420	25	36	206	412	24	38	210		313				300	8.9	151	300	383
500	12	21	199	557	25		240		413	9.2	140		400	4.4	110	400	371
600	11	20	106	657	6		340		552	23	70	BLDU	500	14	84	500	556
700	6	8	42	757	13		110		629	14	80	BLDU	600	11	108	600	856
800	5	9	169	857	11		200		746	10	140		700	7.4	133	700	390
900	6	10	232	957	15		200		844	9.2	160		800	7.1	175	800	239
1000	13	19	206	1057	9		200		942	16	130	BLDU	900	4.9	147	900	188
1100	17	27	200	1157	11	21	200		1047	21	160	BLDU	1000	7.2	124	1000	216
1200	16	25	209	1257	16		180		1140	15	160		1100	11	119	1100	175
1300	15	23	190	1357	20		200		1243	13	150		1200	8.8	141	1200	164
1400	18	26	199	1457	17		200		1353	12	160		1300	8.7	142	1300	107
1500	14	21	178	1557	14		210		1452	15	150		1400	7.6	157	1400	57
1600	16	23	199	1657	14		200		1547	13	140		1500	7.2	147	1500	41
1700	15	21	203	1757	13		200		1640	16	150		1600	9.1	137	1600	40
1800	15	21	203	1857	9		200		1751	14	150		1700	9.4	132	1700	35
1900	13	18	196	1957	7		190		1842	13	140		1800	7.9	129	1800	33
2000	10	16	188	2057	10		200		1952	10	130		1900	7.7	129	1900	46
2100	10	17	178	2157	8		200		2040	17	130		2000	9	130	2000	24
2200	10	15	179	2257	11		170		2141	12	130		2100	9.2	127	2100	20
2300	12	18	169	2357	14		170		2246	9.2	110		2200	8.6	128	2200	18
0	10	15	167	57	10		170		2340	13	130		2300	8.5	133	2300	13

\*Blue hours indicate July 29, 2016. Wind data for KNYL, from the NCEI's QCLCD system. Westmorland PM<sub>10</sub> data from AQS. Westmorland does not measure wind gusts. Mexicali Airport wind data and San Luis Colorado from the University of Utah's MesoWest. San Luis Rio Colorado and KNYL both adjusted to PST. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DS=Dust Storm

As mentioned above by early Friday, July 29, 2016 the NWS in Phoenix described the expected storms as efficient wind producers causing large areas of the desert to experience outflow winds. By 308 am PST (408 am PDT) Saturday, July 30, 2016 the San Diego NWS office described what in their opinion would have been an impressive haboob across the lower deserts under the cover of darkness. Although wind gusts measured less than 50 mph across Imperial County the strength of the outflow winds at Gila Bend, about 100 due east of the CA-Z border, reached 90 mph.<sup>18</sup> The San Diego NWS office similarly identified reduced visibility in El Centro, Thermal and Palm Springs.

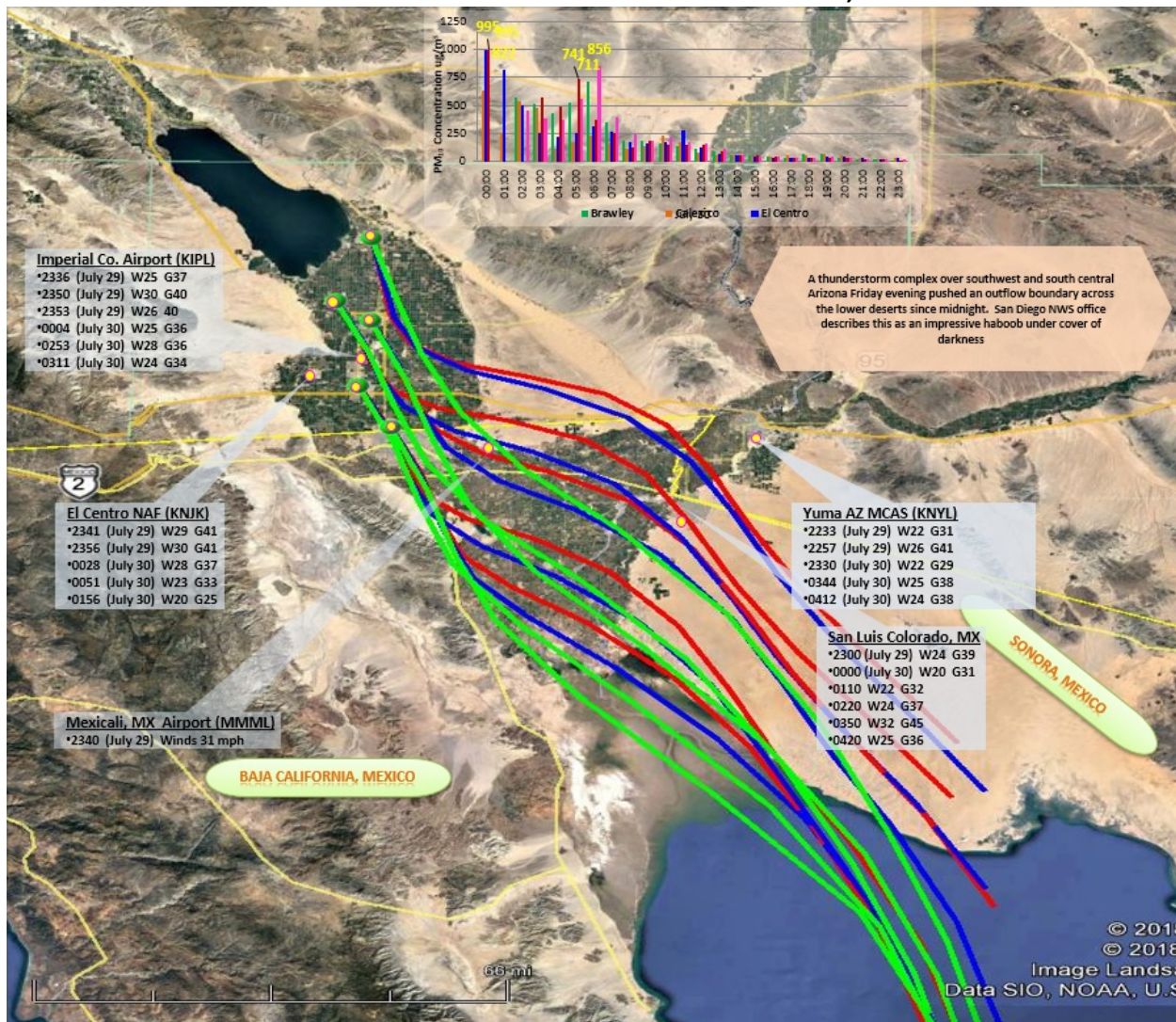
Locally, all airports, including the Yuma MCAS (KNYL) and Mexicali International Airport all measured elevated gusty winds during the evening hours of July 29, 2016 through the morning hours of July 30, 2016. KNYL reported a dust storm at 2257 PST (2357 MST) on July 29, 2016. The Mexicali airport reported multiple incidents of blowing dust starting at 0013 PST July 30, 2016.

**Figure 5-6** illustrated a 12 hour HYSPLIT back-trajectory ending at the air monitors in Imperial County at 1200 PST. Hours prior to the 1200 PST, gusty winds created by the pushing of outflow boundaries from an active thunderstorm complex over south and south central Arizona travelled over natural open desert areas, farmland and populated centers in Baja California and northern Mexico before affecting air monitors in Imperial County.

---

<sup>18</sup> Area Forecast Discussion, National Weather Service San Diego CA, 308am PST (408 am PDT) Saturday, July 30, 2016.

**FIGURE 5-7**  
**EXCEEDANCE ANALYSIS FOR SATURDAY JULY 30, 2016**

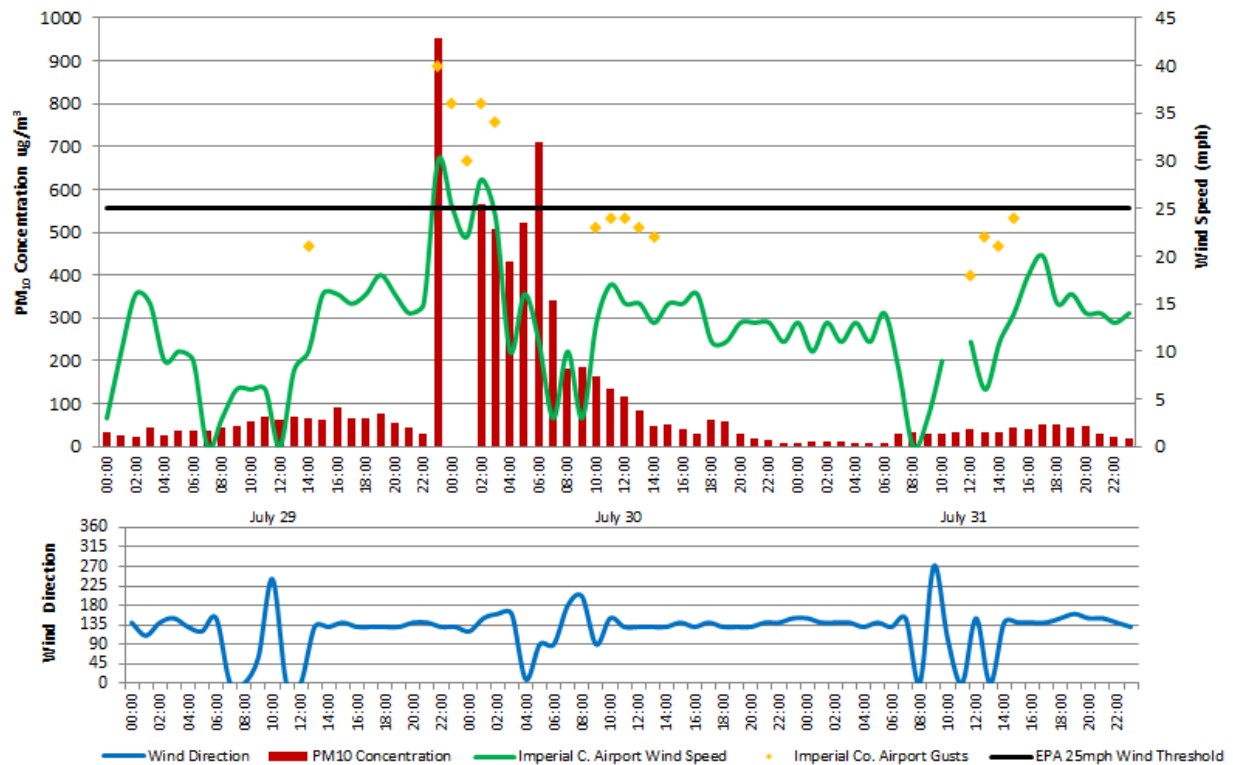


**Fig 5-7:** The 12-hour HYSPLIT trajectory indicates the path of airflow as it travelled to the air monitors in Imperial County by 1200 PST on June 30, 2016. The 1200 PST hour is coincide with the last hour when air monitors measured concentrations at or above 100  $\mu\text{g}/\text{m}^3$ . After 1200 PST wind speeds and gust reduced. Red trajectory indicates airflow at 10 meters AGL (above ground level); blue indicates airflow at 100m; green is 500m. Yellow line indicates the international border. Aqua lines denote county boundaries. Dynamically generated through NOAA's Air Resources Laboratory HYSPLIT model. Base map from Google Earth

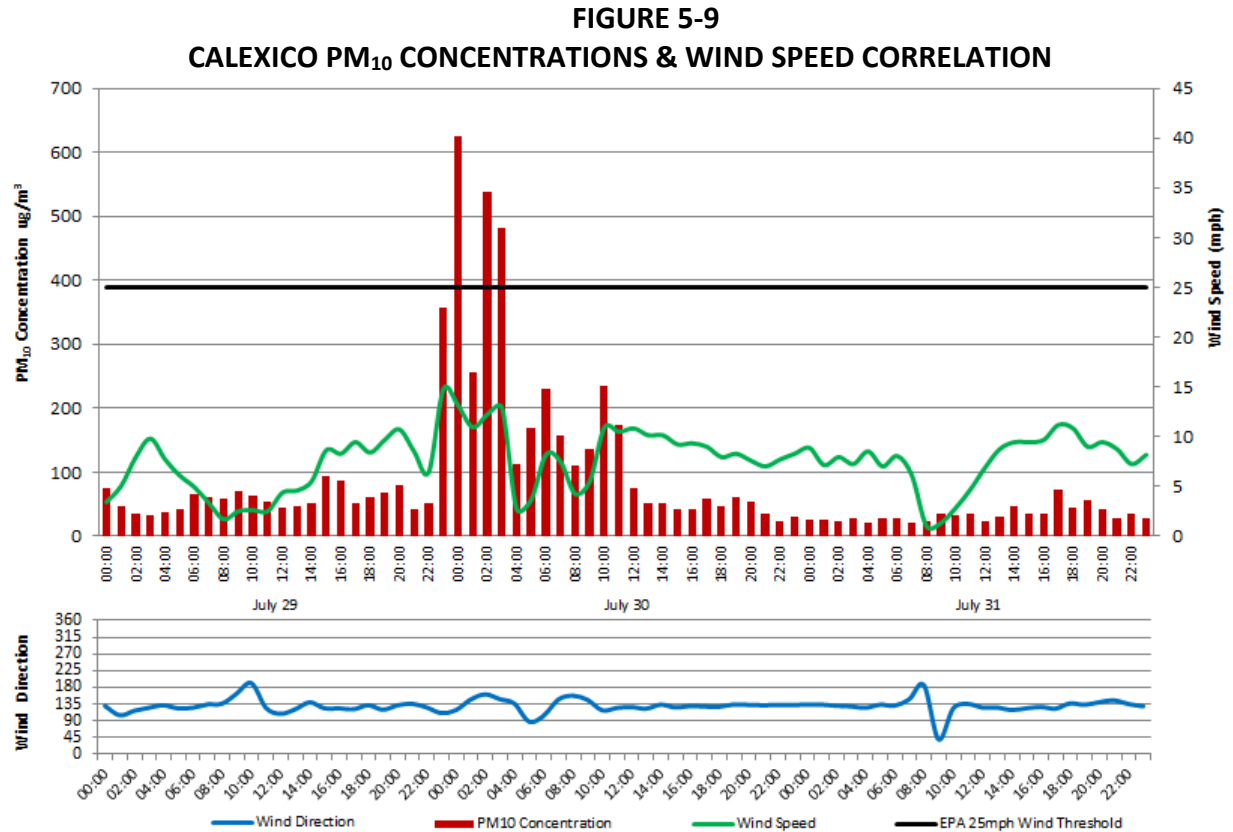
**Figures 5-8 through 5-12** depict  $\text{PM}_{10}$  concentrations and wind speeds over a 72-hour period at the Brawley, Calexico, El Centro, Niland and Westmorland monitors. Because the active thunderstorm complex was an efficient wind producer, large areas of the desert experienced outflow winds. The primary component of the winds were the gusts. While in many instances winds remained moderately elevated gusts created suspended windblown dust to saturate the

air and the monitors. Fluctuations in hourly concentrations at the monitors over 72 hours show a positive correlation with wind speeds and gusts at upstream sites.

**FIGURE 5-8**  
**BRAWLEY PM<sub>10</sub> CONCENTRATIONS & WIND SPEED CORRELATION**

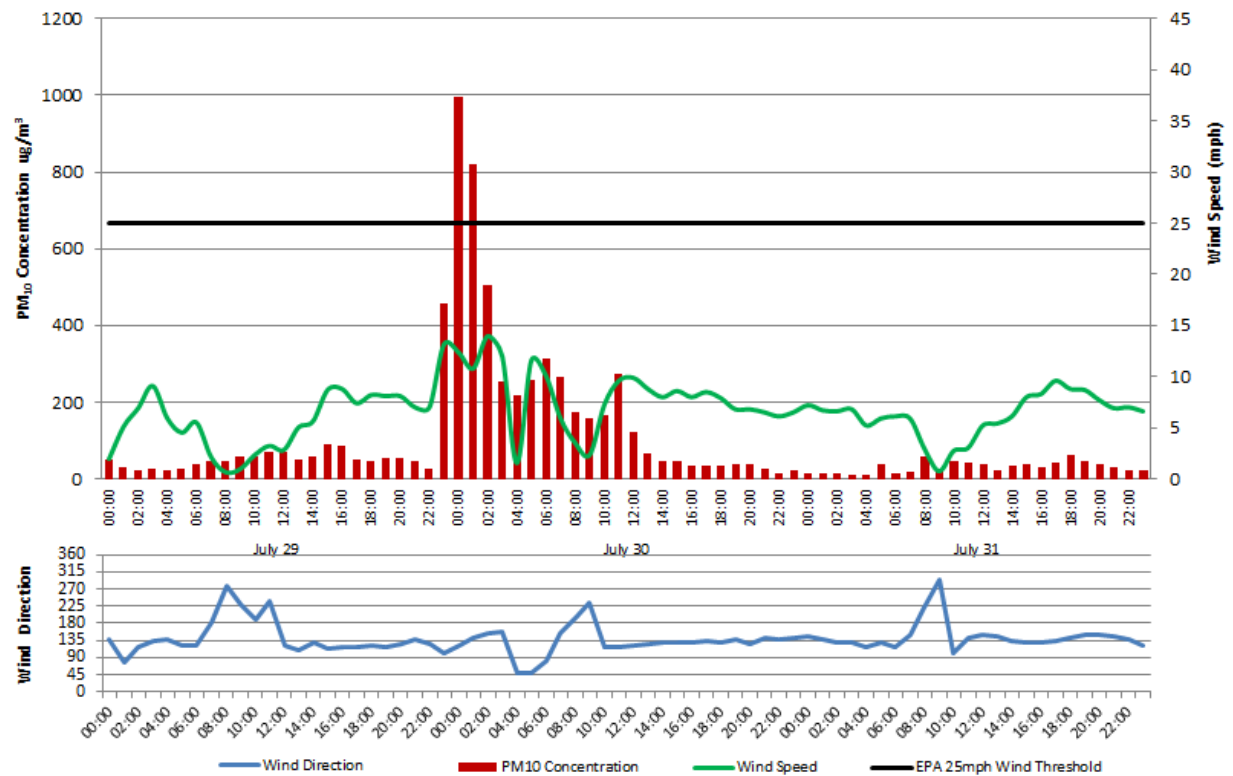


**Fig 5-8:** Fluctuations in hourly concentrations over 72 hours show a positive correlation between elevated wind speeds, and particularly gusts, at Imperial County Airport (KIPL). The Brawley station does not measure wind. Black line indicates 25 mph threshold. Air quality data from the EPA's AQS data bank. Wind data from the NCEI's QCLCD system



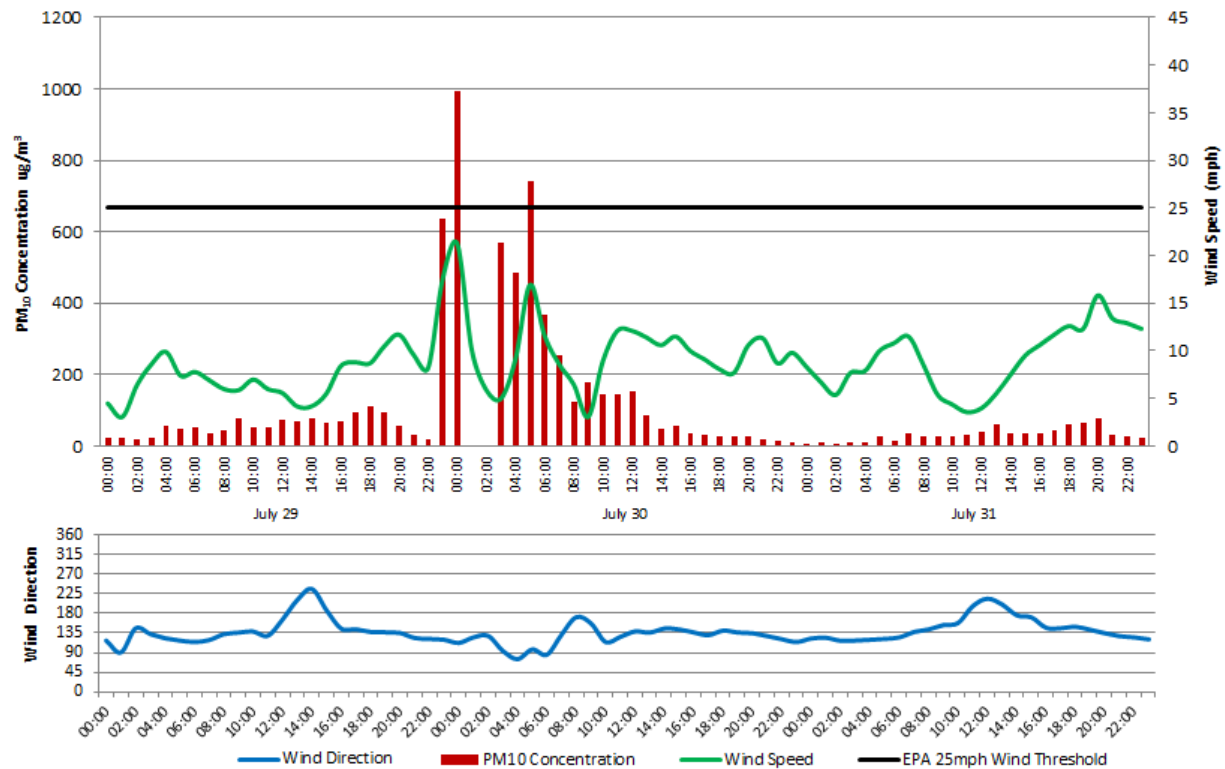
**Fig 5-9:** As mentioned above, winds remained at moderate levels however, gusts, which is not measured by the Calexico station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

**FIGURE 5-10**  
**EL CENTRO PM<sub>10</sub> CONCENTRATIONS & WIND SPEED CORRELATION**

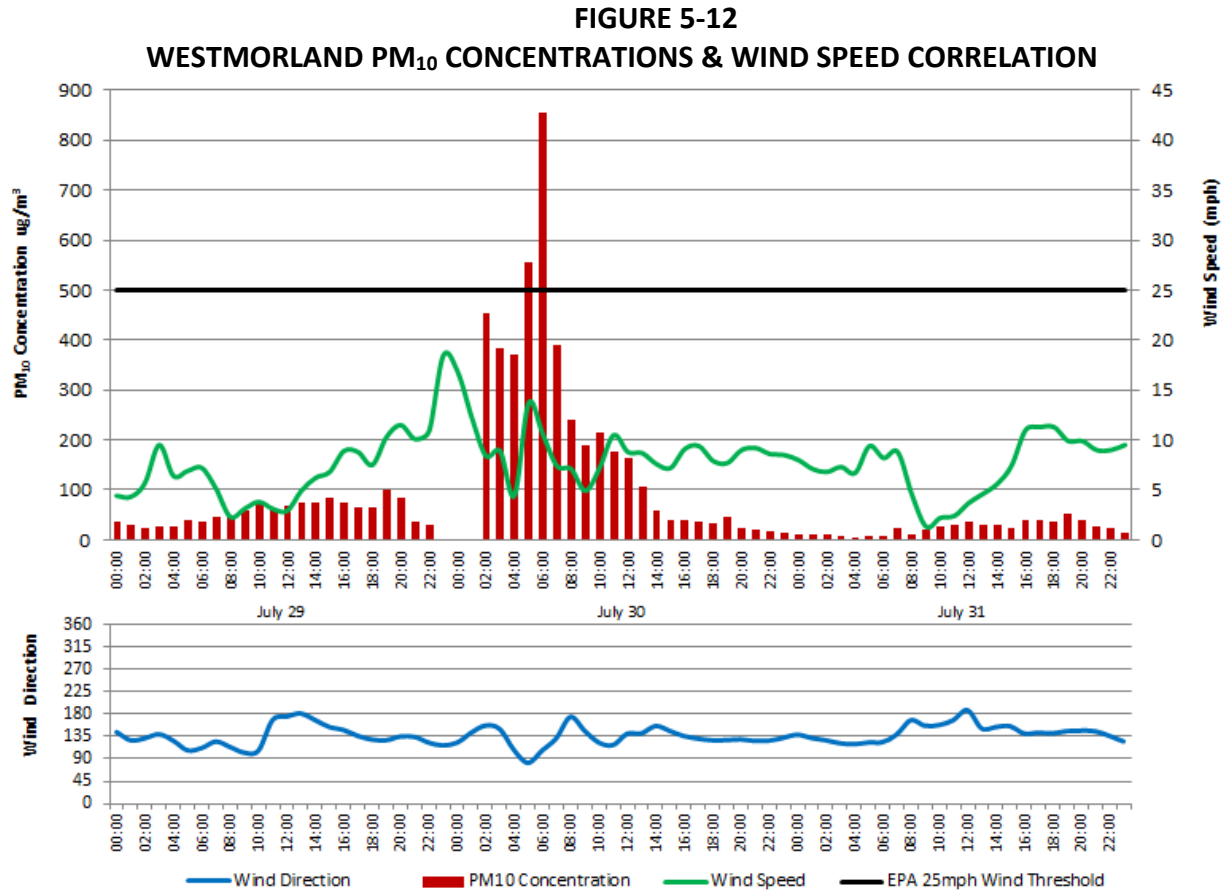


**Fig 5-10:** As mentioned above, winds remained at moderate levels however, gusts, which is not measured by the El Centro station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

**FIGURE 5-11**  
**NILAND PM<sub>10</sub> CONCENTRATIONS & WIND SPEED CORRELATION**

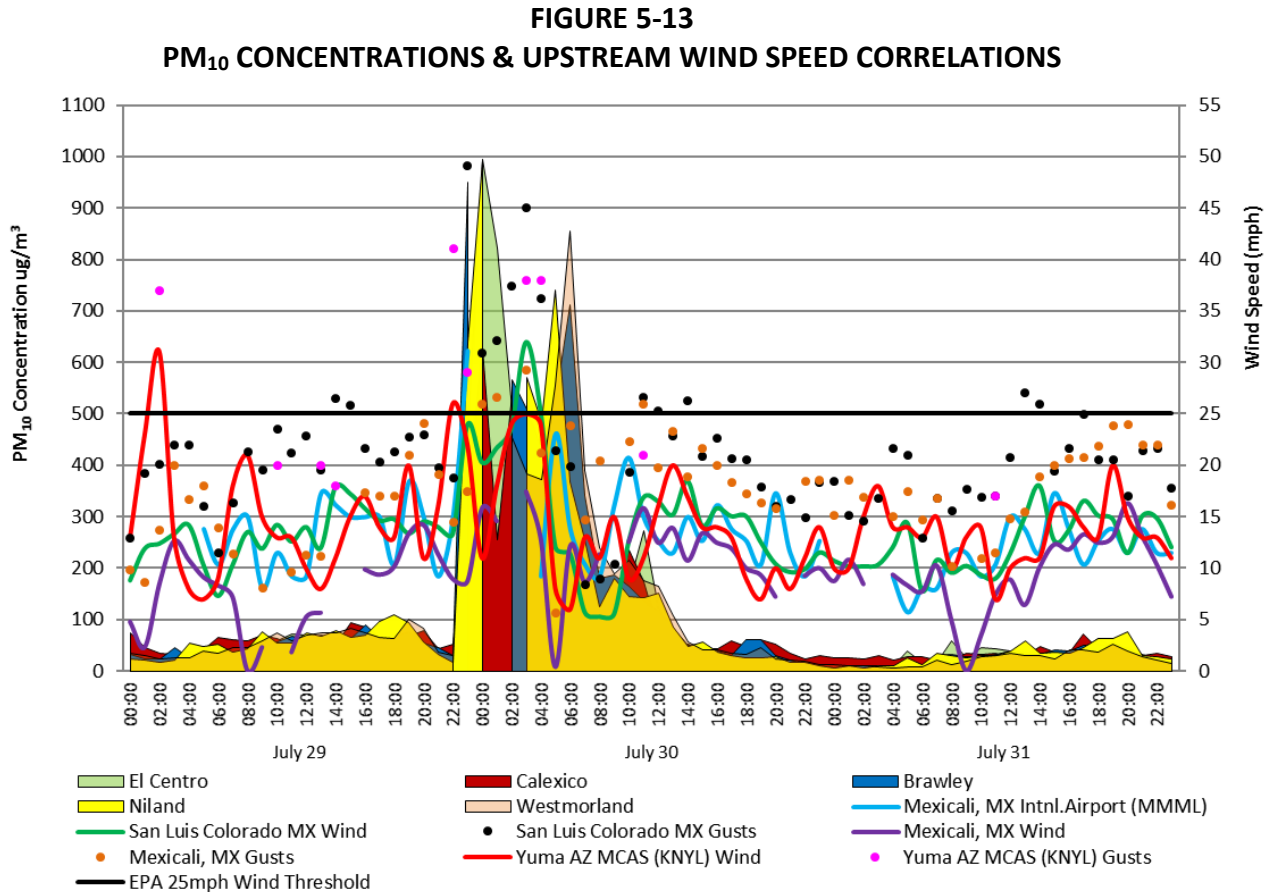


**Fig 5-11:** As mentioned above, winds remained at moderate levels however, gusts, which is not measured by the Niland station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank



**Fig 5-12:** As mentioned above, winds remained at moderate levels however, gusts, which is not measured by the Niland station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

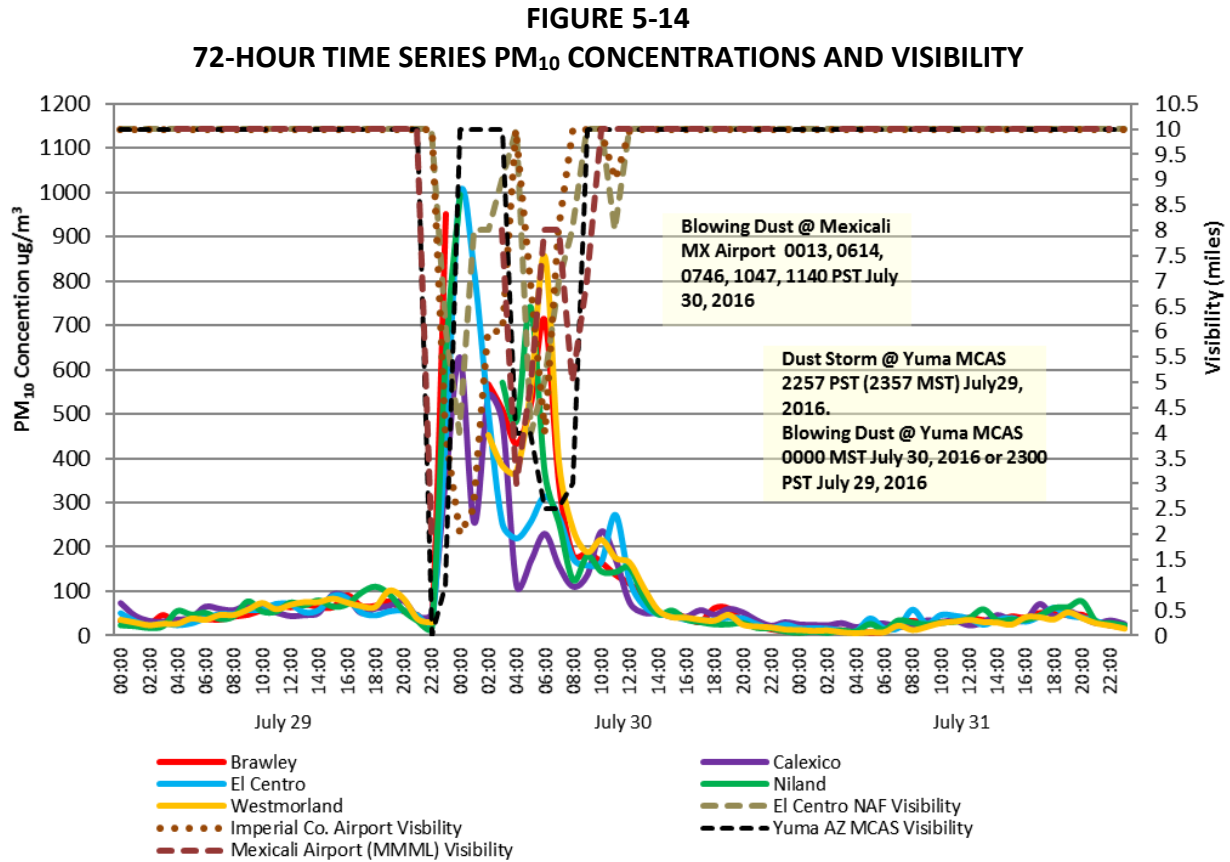
**Figure 5-13** depicts the relationship between the 72-hour PM<sub>10</sub> fluctuations measured by the Brawley, Calexico, El Centro, Niland, and Westmorland monitors and the measured wind speeds and gusts. **Appendix C** contains additional graphs illustrating the relationship between PM<sub>10</sub> concentrations and wind speeds from regional monitoring sites within Imperial County, eastern Riverside County, and Yuma, Arizona during the wind event.



**Fig 5-13:** A graphical depiction of the 72-hour PM<sub>10</sub> fluctuations as measured by the Brawley, Calexico, El Centro, Niland and Westmorland monitors compared to upstream wind speeds. A positive correlation between increases in wind speeds is evident with emphasis given to the correlation between concentrations and wind gusts. Black line indicates the 25 mph threshold

**Figure 5-14** compares the 72-hour concentrations at the Brawley, Calexico, El Centro, Westmorland, and Niland with visibility<sup>19</sup> at local airports between July 29, 2016 and July 31, 2016. Generally, drops in visibility correspond to highest hourly concentrations at the monitors.

<sup>19</sup> According to the NWS there is a difference between human visibility and the visibility measured by an Automated Surface Observing System (ASOS) or an Automated Weather Observing System (AWOS). The automated sensors measure clarity of the air vs. how far one can “see”. The more moisture, dust, snow, rain, or particles in the light beam the more light scattered. The sensor measures the return every 30 seconds. The visibility value transmitted is the average 1-minute value from the past 10 minutes. The sensor samples only a small segment of the atmosphere, 0.75 feet therefore an algorithm is used to provide a representative visibility. Siting of the visibility sensor is critical and large areas should provide multiple sensors to provide a representative observation; <http://www.nws.noaa.gov/asos/vsby.htm>.



**Fig 5-4:** Visibility as reported by the Mexicali, Mexico International Airport (MMML), Imperial County Airport (KIPL), El Centro NAF (KNJK), and Yuma MCAS (KNYL) provides a correlation between reduced visibility and measured peak concentrations at the Brawley, Calexico, El Centro, Niland and Westmorland monitors. Visibility data from the University of Utah's MesoWest

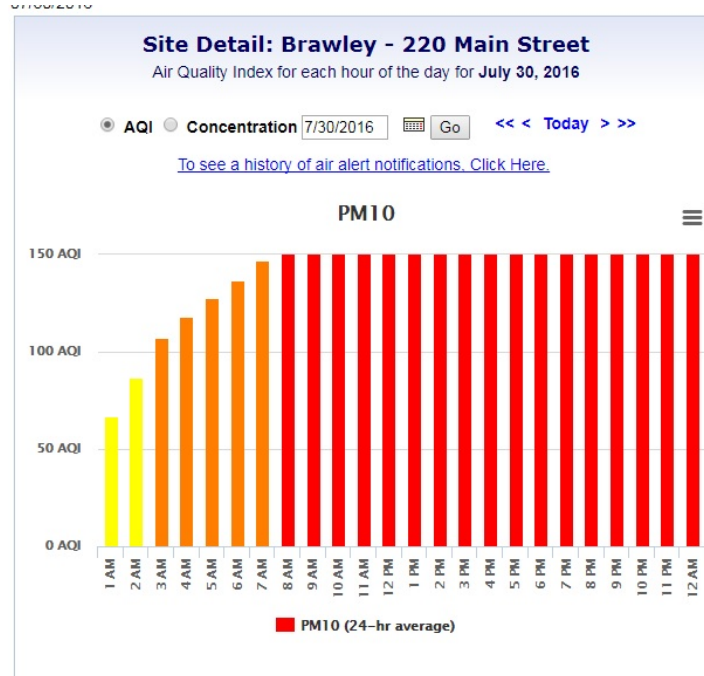
As mentioned above, the Phoenix NWS office issued Urgent Weather Messages, Special Weather Statements, and Preliminary Storm Reports, Bulletins and watches, indicating dense and widespread dust resulting from outflow winds associated with a very active thunderstorm complex. The thunderstorm complex pushed outflow boundaries into Imperial County as early as Friday, July 29, 2016 through Saturday, July 30, 2016. Windblown dust affected air quality and air monitors causing an exceedance on July 30, 2016.

**Figures 5-15 through 5-19** illustrate the level of the Air Quality Index (AQI) in Brawley, Calexico, El Centro, Niland and Westmorland.<sup>20</sup> In each case, air quality progressively degraded as

<sup>20</sup> The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country. Source: <https://www.airnow.gov/index.cfm?action=aqibasics.aqi>

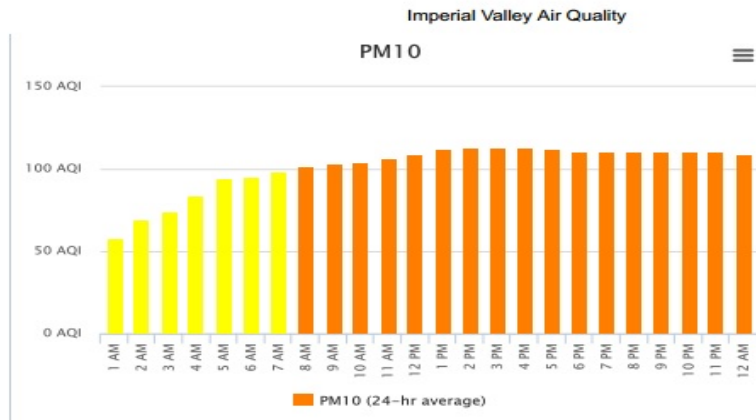
windblown dust settled. The AQI at each monitor reached “Orange” or Unhealthy for Sensitive Groups level (PM10 101-150  $\mu\text{g}/\text{m}^3$ ) through the day with the Brawley monitor reaching “Red” or Unhealthy level (PM10 151-200  $\mu\text{g}/\text{m}^3$ ). Because averaging times for each AQI hour reflects the previous 24 hours, the impact to air quality is extrapolated in accordance with the time dust settles. **Appendix A** contains a copy of notices pertinent to the July 30, 2016 event.

**FIGURE 5-15**  
**IMPERIAL VALLEY AIR QUALITY INDEX IN BRAWLEY**  
**JULY 30, 2016**



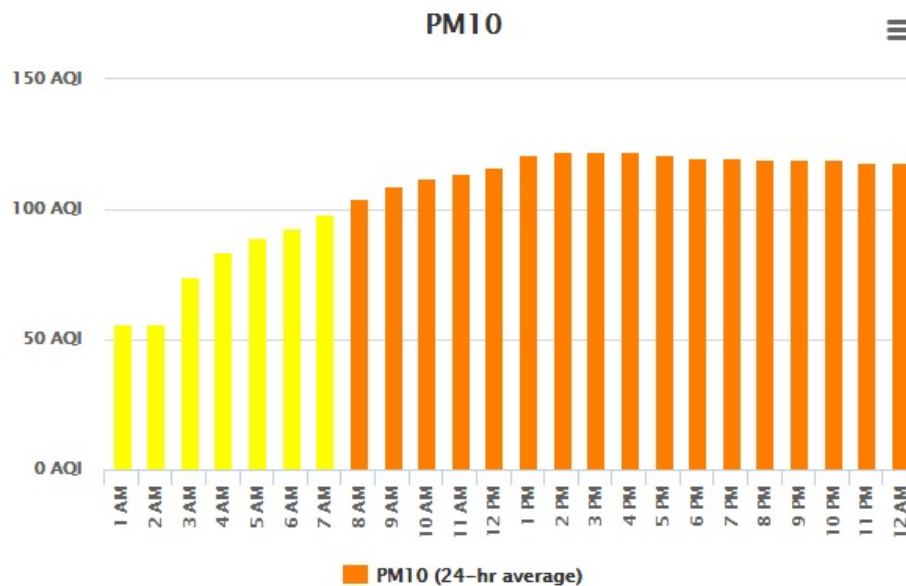
**Fig 5-15:** Reduced air quality is evident when warnings go from a moderate or yellow level to an unhealthy or red level. Source: ICAPCD archives

**FIGURE 5-16**  
**IMPERIAL VALLEY AIR QUALITY INDEX IN CALEXICO**  
**JULY 30, 2016**



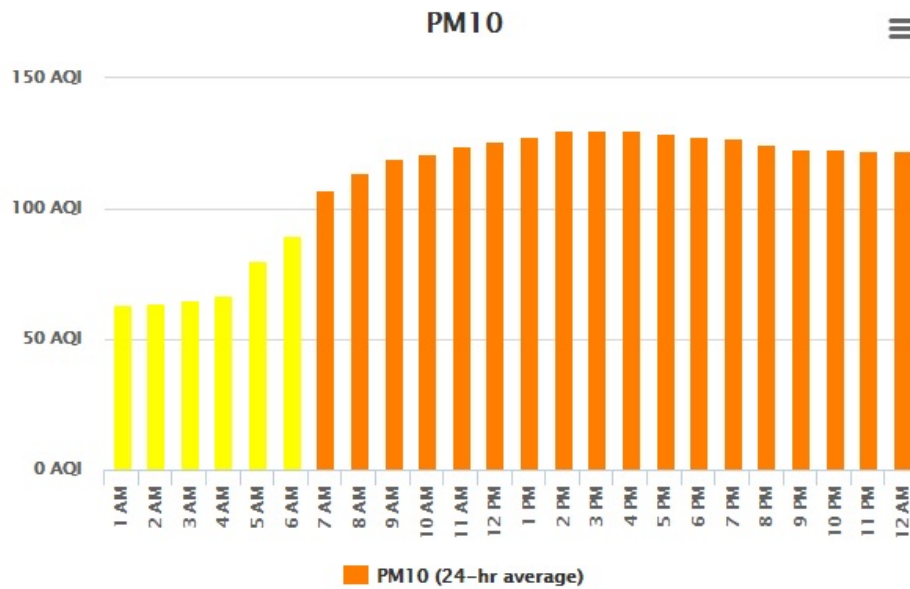
**Fig 5-16:** Reduced air quality is evident when warnings go from a moderate or yellow level to an unhealthy for sensitive receptor or orange level. Source: ICAPCD archives

**FIGURE 5-17**  
**IMPERIAL VALLEY AIR QUALITY INDEX IN EL CENTRO**  
**JULY 30, 2016**



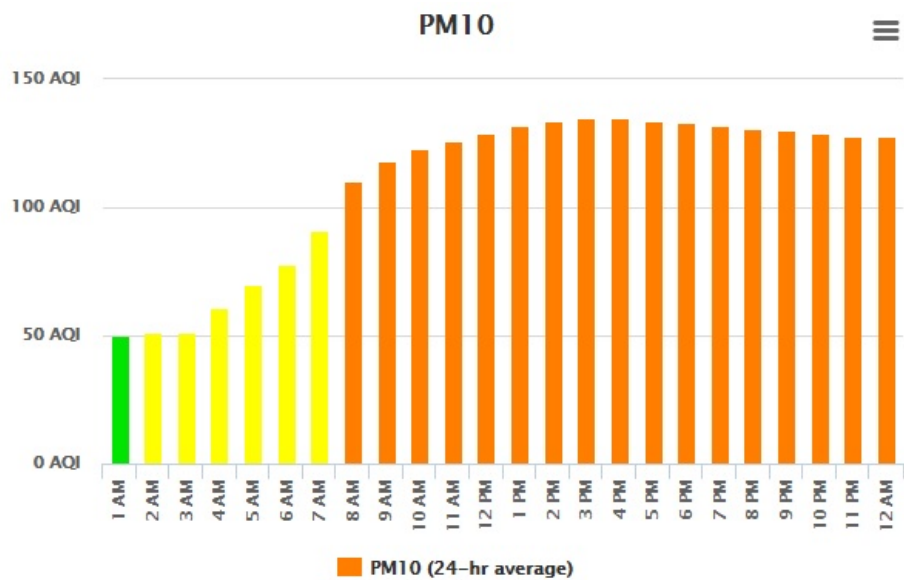
**Fig 5-17:** Reduced air quality is evident when warnings go from a moderate or yellow level to an unhealthy for sensitive groups or orange level. Source: ICAPCD archives

**FIGURE 5-18**  
**IMPERIAL VALLEY AIR QUALITY INDEX IN NILAND**  
**JULY 30, 2016**



**Fig 5-18:** Reduced air quality is evident when warnings go from a moderate or yellow level to an unhealthy for sensitive groups or orange level. Source: ICAPCD archives

**FIGURE 5-19**  
**IMPERIAL VALLEY AIR QUALITY INDEX IN WESTMORLAND**  
**JULY 30, 2016**

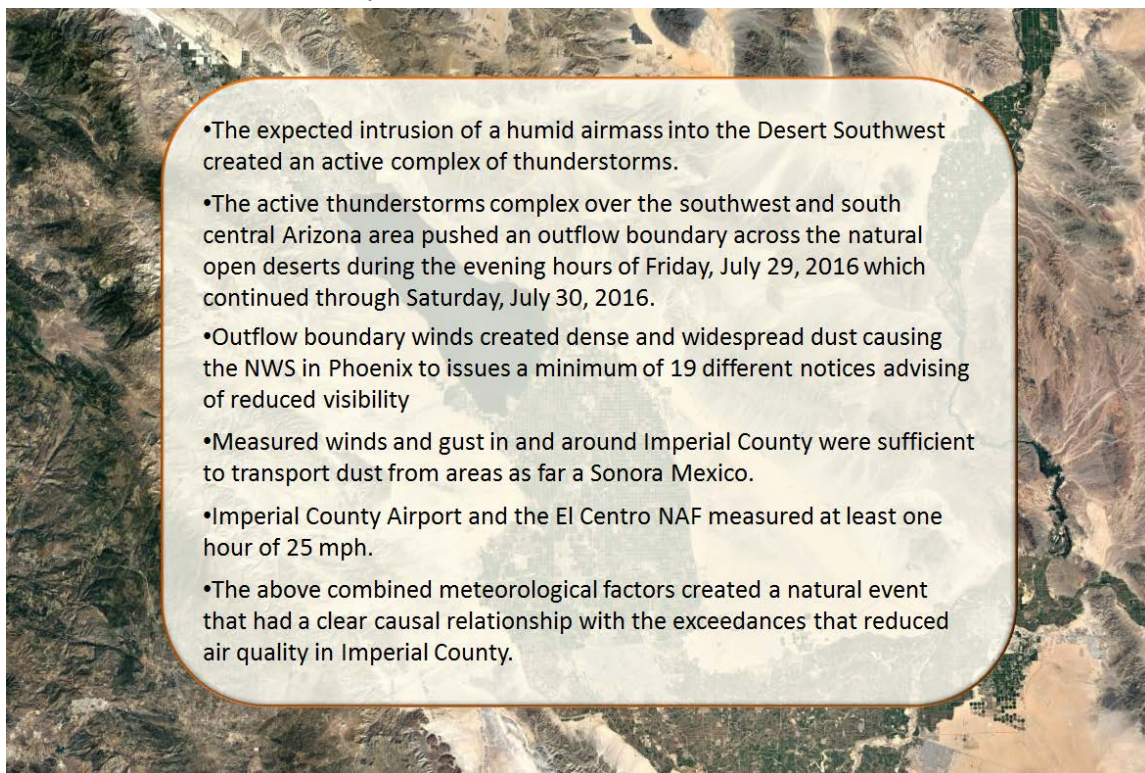


**Fig 5-19:** Reduced air quality is evident when warnings go from a moderate or yellow level to an unhealthy for sensitive groups or orange level. Source: ICAPCD archives

## V.2 Summary

The preceding discussion, graphs, figures, and tables provide wind direction, wind speed and concentration data illustrating the spatial and temporal effects of the strong outflow winds that arose from a very active thunderstorm complex that pushed an outflow boundary into Imperial County during the evening hours of July 29, 2016 through Saturday, July 30, 2016. The information provides a clear causal relationship between the entrained windblown dust and the PM<sub>10</sub> exceedance measured at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors on July 30, 2016. Furthermore, the advisories and air quality index illustrate the affect upon air quality within the region extending from the southwest portion of Yuma County, Arizona, all of Imperial County, and the southern portion of Riverside County. Large amounts of coarse particles (dust) and PM<sub>10</sub> were transported by gusty outflow winds into the lower atmosphere causing a change in air quality within Imperial County. The entrained dust originated from as far as the desert areas located within Sonora State of northern Mexico, northern Baja California and southeast Imperial County (part of the Sonoran Desert). Combined, the information demonstrates that the elevated PM<sub>10</sub> concentrations measured on July 30, 2016 coincided with high wind speeds and that gusty southerly winds were experienced over the southern portion of Riverside County, southeastern San Diego County, all of Imperial County, and parts of Arizona.

**FIGURE 5-20**  
**JULY 30, 2016 WIND EVENT TAKEAWAY POINTS**



**Fig 5-20:** Is a summary of the meteorological conditions and facts that qualify the July 30, 2016 event, which affected air quality as an Exceptional Event

## VI Conclusions

The PM<sub>10</sub> exceedance that occurred on July 30, 2016, satisfies the criteria of the EER which states that in order to justify the exclusion of air quality monitoring data evidence must be provided for the following elements:

TABLE 6-1 TECHNICAL ELEMENTS CHECKLIST		
EXCEPTIONAL EVENT DEMONSTRATION FOR HIGH WIND DUST EVENT (PM <sub>10</sub> )		DOCUMENT SECTION
1	A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	6-36; 86
2	A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation	60-84; 85
3	Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the requirement at paragraph (c)(3)(iv)(B) of this section	37-51; 86
4	A demonstration that the event was both not reasonably controllable and not reasonably preventable	52-59; 85
5	A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event	60-84; 85

### VI.1 Affects Air Quality

The preamble to the revised EER states that an event is considered to have affected air quality if it can be demonstrated that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation. Given the information presented in this demonstration, particularly Section V, we can reasonably conclude that there exists a clear causal relationship between the monitored exceedance and the July 30, 2016 event which changed or affected air quality in Imperial County.

### VI.2 Not Reasonably Controllable or Preventable

In order for an event to be defined as an exceptional event under section 50.1(j) of 40 CFR Part 50 an event must be “not reasonably controllable or preventable.” The revised preamble explains that the nRCP has two prongs, not reasonably preventable and not reasonably controllable. The nRCP is met for natural events where high wind events entrain dust from desert areas, whose sources are controlled by BACM, where human activity played little or no direct causal role. This demonstration provides evidence that despite BACM in place within Imperial

County, high winds overwhelmed all BACM controls where human activity played little to no direct causal role. The PM<sub>10</sub> exceedance measured at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors were caused by naturally occurring strong gusty west winds that transported fugitive dust into Imperial County and other parts of southern California from areas located within the Sonoran Desert regions of northern Mexico to the south of Imperial County. These facts provide strong evidence that the PM<sub>10</sub> exceedances at Brawley, Calexico, El Centro, Niland, and Westmorland on July 30, 2016, were not reasonably controllable or preventable.

### **VI.3 Natural Event**

The revised preamble to the EER clarifies that a “Natural Event” (50.1(k) of 40 CFR Part 50) is an event and its resulting emissions, which may recur at the same location where anthropogenic sources that are reasonably controlled are considered not to play a direct role in causing emissions, thus meeting the criteria that human activity played little or no direct causal role. As discussed within this demonstration, the PM<sub>10</sub> exceedances that occurred at Brawley, Calexico, El Centro, and Westmorland on July 30, 2016, were caused by the transport of fugitive dust into Imperial County by strong southerly winds associated with a mass of monsoonal air that surged northward out of Mexico. At the time of the event anthropogenic sources were reasonably controlled with BACM. The event therefore qualifies as a natural event.

### **VI.4 Clear Causal Relationship**

The time series plots of PM<sub>10</sub> concentrations at Brawley, Westmorland, and Niland during different days, and the comparative analysis of different areas in Imperial and Riverside county monitors demonstrates a consistency of elevated gusty west winds and concentrations of PM<sub>10</sub> at the Brawley, Calexico, El Centro, Niland, and Westmorland monitoring stations on July 30, 2016, (Section V). In addition, these time series plots and graphs demonstrate that the high PM<sub>10</sub> concentrations and the gusty west winds were an event that was widespread, regional and not preventable. Arid conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by the elevated gusty west winds. Days immediately before and after the high wind event PM<sub>10</sub> concentrations were well below the NAAQS. Overall, the demonstration provides evidence of the strong correlation between the natural event and the entrained fugitive emissions to the exceedances on July 30, 2016.

### **VI.5 Historical Concentrations**

The historical annual and seasonal 24-hr average PM<sub>10</sub> values measured at the Brawley, Calexico, El Centro, Niland, and Westmorland monitors were historically unusual compared to a multi-year data set (Section III).

**Appendix A: Public Notification that a potential event was occurring (40 CFR §50.14(c)(1))**

This section contains wind advisories issued by the National Weather Service and Imperial County on or around July 30, 2016. In addition, this Appendix contains the air quality alert issued by Imperial County advising sensitive receptors of potentially unhealthy conditions in Imperial County resulting from the strong gusty winds. The data show a region-wide increase in wind speeds and wind gusts coincident with the arrival of dust and high PM<sub>10</sub> concentrations in Imperial County.

**Appendix B: Meteorological Data.**

This Appendix contains the time series plots, graphs, wind roses, etc. for selected monitors in Imperial and Riverside Counties. These plots, graphs and tables demonstrate the regional impact of the wind event.

**Appendix C: Correlated PM<sub>10</sub> Concentrations and Winds.**

This Appendix contains the graphs depicting the correlations between PM<sub>10</sub> Concentrations and elevated wind speeds for selected monitors in Imperial and Riverside Counties. These graphs demonstrate the region wide impact of the wind event.

**Appendix D: Regulation VIII – Fugitive Dust Rule.**

This Appendix contains the compilation of the BACM adopted by the Imperial County Air Pollution Control District and approved by the United States Environmental Protection Agency. A total of seven rules numbered 800 through 806 comprise the set of Regulation VIII Fugitive Dust Rules.